JOURNAL

OF

SCIENCE AND THE ARTS.

EDITED AT THE ROYAL INSTITUTION
OF GREAT BRITAIN.

PUBLISHED QUARTERLY.

VOL. III.

LONDON:

JOHN MURRAY, ALBEMARLE-STREET.

1817.

London: printed by W. Bulmer and Co.
Cleveland-row, St. James's.

CONTENTS

TO

Nº V.

ERRATUM.

Page 12, line 24, for *tantochronic* read *tautochronic*.

CONTENTS

TO

No VI.

CONTENTS.

ON THE

ADVANCEMENT OF SCIENCE,

AS CONNECTED WITH

THE RISE AND PROGRESS

OF THE

ROYAL INSTITUTION.

In terminating the first year of their labours, the Editors of the Journal of the Royal Institution are urged by weighty considerations to take a retrospective view of the general progress of science and to collect together the scattered facts which form the degrees of a scale whereon to measure the advancement of knowledge and the improvement of the human intellect. To those who tread the unbeaten paths of unexplored regions, it is refreshing to pause and look back upon the tract which has been past, and the contemplation of difficulties overcome and progress made inspires fresh vigour for exertion, and assists in forming useful anticipations of future prospects. Nothing is more animating than to connect with our own the toils of our fellow-

labourers; and the circle of our pursuits seems to expand as we contemplate the concentric efforts of others, and view the unity of design of the whole combined. It can but rarely happen that the concentrated genius of ages; and the multifarious science of a wide-extended world, should be traced before us by a master's hand, in one clear and highly finished picture; but when such a view is offered, we know of no greater intellectual treat; we seek for no greater incentive to perseverance. Our own efforts rise to importance as parts of the superstructure which had its foundation in collected wisdom, and we feel the invincible enthusiasm of the followers of a victorious chief, as we range ourselves under the banners of Newton, of Bacon, and of Boyle. If Mathematicians, we behold the abstruse calculations of numbers and of space applied to the forms of matter; and we contemplate with no less wonder and delight the Chemist calculating the composition of bodies by figures, and conducting analyses by a scale, than the Astronomer weighing the masses of the planets, and computing the revolutions of a system: as Astronomers, we see the Mineralogist applying the laws of gravity to an atom, and developing an analogy between invisible molecules and the heavenly spheres; and we ourselves borrow the observations of the Geologist to correct our calculations and perfect our means of inquiry: we feel conscious that the pursuits of science, however various in appearance, are insepa-

rably linked together; and we return with double relish each to our respective study, conscious of a wider field and almost of enlarged powers of research. Such are the advantages which we derive from the encyclopædiacal eloquence of a Stewart or a Playfair —Something of the same spirit may be caught from a less expanded retrospect; and we trust, that in presenting to our readers an annual sketch of the progress of science, we shall be performing an useful and acceptable service.

But higher motives influence us on the present occasion, and will constrain us, while we extend the period of our inquiry, to bound our review to a narrower circle. We do not now address the public as mere Journalists, but we raise the voice of the Royal Institution of Great Britain; and in tracing rapidly the march of science from the foundation of our establishment, we shall reclaim with pride the concentrated glory of discoveries, which would have shed no mean lustre, diffused over the philosophy of an age.

On the first proposition for this Philosophical Association in the year 1800, one of the principal objections to it was, that it would tend to diminish the importance of our elder establishments: a practical argument against this idea we will now give, upon the experience of seventeen years, by referring principally to the annals of the Royal Society, for the record of our services. Nor will it be any disparagement to the dignity of that venerable

body to shew, that some of the fairest flowers of her later Transactions were sown and nurtured by the experimental manipulations not of a jealous rival, but of an useful and laborious ally.

The history of chemical science must for ever date one of its principal epochs from the foundation of the Laboratory of the Royal Institution. The reformed doctrines of the French school were but just firmly established by the powerful engine of her nomenclature, and the expiring groans of the phlogistic hypothesis, were still heard in the last writings of Dr. Priestley, when a new power of nature was developed by the experiments of Galvani, and a new and powerful instrument of research, combined by the genius of Volta. The experimentalists of our school were not behind others in their investigations of the laws of Galvanism; and various were their improvements in the Voltaic apparatus, till its splendid powers were first fully displayed in giant greatness, in the battery of the Institution. The impulse which was given to science by these striking discoveries, vibrated to every part of the civilized world, and the crowded lectures in which such wonderful novelties were displayed with all the powers of eloquence, and all the aids of a splendid apparatus, contributed not a little in this country, to the rapid diffusion of a taste for philosophic inquiry.

Nor was it only in the higher walks of science, that the rising establishment distinguished the

opening of her career. Let those come forward and bear witness to her useful attention to minor subjects, who have received the ready assistance of her out-stretched hand. The processes of one highly important manufacture, in particular, were first submitted to investigation within her walls, and from these illustrations and experiments in the art of tanning and leather-making, were derived the first just ideas of important improvements, founded upon scientific principles. The agriculturist, the manufacturer, and the miner, have all received, in their various pursuits, gratuitous and cheerful aid; and the intercourse which has been facilitated in her apartments, between patrons of science, scientific men, and the promoters of manufactures and arts, has tended to inspire that activity and energy which springs most luxuriantly from the free interchange of opinion.

The mechanical sciences, likewise received their due share of patronage and advancement, and nothing was omitted which could tend to the improvement of the arts, subservient to the conveniences of life. In the courses of lectures delivered by the Professor of Natural Philosophy, the fundamental doctrines of motion were referred to simple mathematical axioms, more immediately than had before been usual, and their application to practical purposes was much facilitated. The passive strength of materials of all kinds, was investigated, and many new conclusions respecting it were

formed, of considerable importance to the engineer and architect: the theory and motion of waves, the circulation of the blood, and the propagation of sound, were simplified, extended, and illustrated. In the science of optics, the functions of the eye, and the curvature of images, formed by lenses and mirrors, were minutely examined and investigated, and some new phenomena of coloured light were pointed out. He also reduced the theory of tides to a simple form, and in investigating the cohesion and capillary action of fluids, he anticipated the conclusions of Laplace. To these may be added, many comparative and useful experiments on the elasticity of steam, and on evaporation.

Nor ought we to pass over in silence, the earlier services of Count Rumford. He was one of the first promoters, if not the original proposer, of our Association; and many of his experiments on the properties and œconomical distribution of heat, which are known in all the countries of Europe, by their useful application; and many of his philanthropic schemes, for the alleviation of distress, in times of scarcity, were devised and executed in this school of science. Whatever were his faults, they are now buried in the last receptacle of human frailty, and his better fame remains to distinguish his name in all future ages, as an experimental philosopher, and a zealous projector for the public good

Thus diffusing on one hand the elements of

science, to crowds of the fashionable world, who were delighted at the new source of instructive amusement thus opened to them, and on the other, maintaining an honourable and emulous contest with the profoundest philosophers of the age, in the paths of discovery and experiment, the Royal Institution rose to a height of distinction which has been rarely attained.

It was now that a light broke forth from her laboratory, whose splendor was to radiate to every branch of chemical science, and which, while it confirmed in some things the generally received doctrines, was destined to effect a revolution in others, as important as it was unlooked for. The splendid means which had been supplied by the liberality of the Society, were happily directed by a Master's hand. The chemical agencies of Electricity were traced with laborious accuracy in the Lectures of the Chemical Professor; and their more full developement in the Philosophical Transactions, will for ever stand one of the most remarkable specimens of accurate induction, which has been produced by the human intellect. Foreign nations were emulous in offering their tribute of admiration to the genius of the Britith school, and the rival policy of a hostile government presented a civic crown to the pre-eminence of transcendent merit.

The fruit of these laborious researches, quickly followed in the decomposition of the fixed alkalies,

which put into the hands of the experimentalist another mean of analysis, scarcely less powerful, or of less universal application than the power from whence it emanated. The energy which was thus communicated to science, spread to all the parts of the civilized world with the rapidity of the electric shock; the rays of the new light were reflected from every quarter; and discoveries, which were but the consequences of the newly-ascertained law of nature, flowed in with a tide which almost overwhelmed the imagination. The decomposition of the earths, of the boracic acid, and the metallization of ammonia, gave reason to anticipate a still greater reduction in the numbers of the undecomposed bodies; and the new views thus opened of the sublime simplicity of the operations of nature, were well calculated to excite fresh ardour in following up the magnificent unity of their design.

The improved processes for obtaining the alkaline metals in large quantities, was no sooner announced from France, than they were adopted here; and throughout these active inquiries, we are at a loss how sufficiently to admire the indefatigable industry which repeated and confirmed with one hand the almost innumerable experiments of others, and unravelled with the other the clue of discovery.

Next to the impetus which the novel display of the secrets of nature gives to the progress of science, may be ranked the increase of power which she derives from the removal of the dead weight of preju-

dice and error. The invention of the telescope and the discovery of Jupiter's satellites were scarcely more conducive to the advancement of astronomy, than the refutation of the hypothesis which placed the earth in the centre of the universe, and supposed the sun to perform its revolution around it. The systematic language of the French school, which had so powerfully contributed to the reform of chemistry, had established not less firmly certain gratuitous assumptions, which were the more dangerous, as they formed parts of a system, and were not destitute of the support of specious analogies. Such were the principles which referred all cases of combustion and acidification indiscriminately to the agency of oxygen, and the dogmatical determination of the nature of the muriatic acid. It is in this field that we again find the British school distinguishing itself; and the same hand which scattered so widely the seeds of discovery, employed in eradicating the deeply-rooted weeds which incumber the soil. It was proved that combustion was the general result of energetic action; and if we were asked to select the discovery which marked most decidedly the genius of a Davy, we should without hesitation adduce the train of experiment, argument, and demonstration, which brought back the science to the strictness of induction, by establishing the theory of chlorine and its compounds. When we consider the talent and experimental skill which was long ranged on the other side of this

intricate question; when we recollect that the chemists of France, Germany, and Sweden, with the majority of those of our own country, long supported the ancient doctrine in one of the acutest controversies which ever sprung from physical researches, we shall own, that if the present almost unanimous conviction is honourable to those from whom it was won, that it is doubly glorious to the discriminating judgment which produced it. The history of opinion in all ages will attest how hard a thing it is

> To chase out of our sight,
> With the plain magic of true reason's light,
> Authority, which did a body boast,
> Though 'twas but air condens'd, and stalk'd about
> Like some old giant's more gigantic ghost,
> To terrify the learned rout.

When a new supporter of combustion was brought to light by the discovery of Iode, the determination of its nature and properties was rendered comparatively easy by the reformation which had taken place, and the reformed theory received additional support from new analogies, the strongest and most convincing.

The theory of definite proportion, the effect of which in advancing the interests of chemistry can only be compared to the revolution formerly produced by the French nomenclature, is the undisputed discovery of the chemists of our native country. The experiments of Higgins and of Dalton have received some of their strongest confirmations

from the activity of the Royal Institution; and the praise of having divested the doctrine of its hypothetical dress, and of having placed before us the harmony of numerical results, without any attendant surmises upon the forms and weights of ultimate atoms, is due to Sir H. Davy.

Nothing can be more disgusting than the ignorant objection which is sometimes made to the discoveries and often abstruse speculations of philosophy, that they lead to no practical good, and are connected in no sensible degree with the arts of life. Such objectors are at a loss to conceive that there should be any connection between the gigantic extension of human power by the steam-engine, and the subtle inquiries of Black into the laws of an etherial fluid. To them the maxim that "knowledge is power," must be demonstrated by the actual contact of cause and effect; and they fail to trace remote consequences to what appear nearly evanescent principles. But even to such, the last great series of experiment, conducted within the walls of our establishment, may appeal for the meed of useful and patriotic exertion. It has been well said, with reference to the train of research to which we allude, that "if Bacon were to revisit the earth, this is exactly such a case as we should choose to place before him, in order to give him, in a small compass, an idea of the advancement which Philosophy had made since the time when he had pointed out to her the route which she ought to pursue." Nothing

fortuitous was in any way connected with the results. The problem to be resolved was in express terms; and the solution, commencing with simple and known principles, ascended step by step to the complete fulfilment of the conditions.

The effect of the explosion of fire damp in coal-mines has long been known and deplored; but the frequency and devastating consequences of it in the last few years, has made every friend of humanity shudder, and look forward with horror to the certainty of its more frequent occurrence, in proportion to the daily-extending progress of the miner in his subterraneous operations. By a late explosion in one of the Newcastle collieries, no less than one hundred and one persons perished in an instant; and the accumulated misery which devolved upon their ruined families, to the amount of above three hundred persons, may be more easily conceived than described. Urged by the heart-rending cry of suffering humanity, Science turned aside from her speculations, and after an examination of the nature of the enemy with which she had to contend, traced, with laborious and often dangerous perseverance, its most recondite principles, and at length presented to the astonished and grateful miner the ignited elements of explosion fluttering harmless in a wire cage. Never was there an invention better calculated to prove to the ignorant the connection between science and the arts of life: never was there a result of induction more satisfactory to

philosophers than the safety-lamp of Sir Humphry Davy.

But whilst proclaiming a train of discoveries whose splendour and importance have never been equalled, and whose bright effulgence will distinguish her name as the names of those in whom she glories as her sons, the Royal Institution has not been unmindful of less striking, though scarcely less useful interests. In the department of Geology, she boasts of the first attempt to describe the strata and mineral productions of Great Britain, with reference to a collection ever open to the public. From the zealous exertions of her Members, this Museum is daily receiving fresh accessions; and it is to be hoped that it will shortly derive, from a plan which is in agitation, an importance inferior to none in Europe. The Mineralogical Collection, if unfortunately not as costly or complete as might be wished, is constantly increasing from the liberality of individuals; and it may be fairly questioned whether, from the Courses of Lectures which are given upon it, and from the illustrations which it affords to the Professor, it is not more really useful than splendid and sumptuous specimens, which never see the light except at the request of some privileged few, or at most are left to gratify the stare of ignorance.

As a school of Chemistry, we boldly challenge competition. In the morning courses of the Pro-

fessor, the elements of the science, its minute details, and the operations of the laboratory are laid down with minuteness and precision. It is here that men of every profession obtain the rudiments of a branch of liberal education, of which general opinion renders it almost disgraceful for any to be ignorant. If the policy of our Colleges requires from the medical student certificates of his competence in this necessary knowledge, the suffrage of the world now calls for it scarcely less imperiously from all who rank as gentlemen. The rapid progress of discovery is here followed with proportionate assiduity; and without the labours of manipulation, the lover of experimental philosophy may see repeated and hear discussed the most novel analyses of the works of nature. Nor of less importance are the popular lectures delivered weekly in our theatre. It is here, that we behold a sight not to be paralleled in the civilized world. It is hither, that our countrywomen flock to give their all-powerful countenance to pursuits which ennoble the mind. While beauty and fashion continue to patronize mental improvement, it will ever be unfashionable to be uninformed; while the female classes exert their influence to keep alive a love of instruction, it will be doubly disgraceful for men to be ignorant. And while we acknowledge with gratitude the benefit which science derives from a patronage which is as irre-

sistible as it is extensive, justice calls upon us to rebut the charge of fickleness. Since the first foundation of the institution, the female part of our audiences has never deserted us. Long may the ladies of London continue to derive "that healthy and refined amusement which results from a perception of the variety and harmony existing in the kingdoms of nature, and to encourage the study of those more elegant departments of science which at once tend to exalt the understanding and purify the heart."*

In the class of Mechanics, our exertions are at present necessarily limited to the popular course delivered once a week. The first principles of the science are laid down with that clearness and pre-

* It was with considerable pain that we lately observed in a publication which we respect, a most unprovoked attack upon the Royal Institution. We will tell the British Critic, that *he advances the cause of ignorance*, who excludes the female sex from knowledge, and debars them from the rational amusement and instruction of the mind. We will tell him that *he sacrifices to the shrine of folly*, who, in a fit of spleen selects a work which displays a "clear and accurate knowledge of the various sub-"jects which it is intended to illustrate and adorn" as a fit text for a diatribe against the school from which the authoress has had the candour to acknowledge that she derives all her advantages. We, too, *protest against the degradation of high talents to silly purposes*, and we warn the Reviewer, that the Royal Institution, which always had the wish, has now the power to expose illiberality, and hold up abuse to the contempt which it deserves.

cision which are suited to a general auditory; and no pains are spared to explain and illustrate the numerous inventions which are perpetually diminishing the toil and adding to the power of our different manufactures We trust that at some future and not very distant period, we may be enabled to render this department as complete as that of chemistry; and that by forming a collection of models, we may be the means of establishing a practical school, in a country which of all others would have most reason to pride itself on such an exhibition.

Lectures on Botany still continue to be delivered, and the name of our Professor of this science is sufficient pledge that justice is done to the interest and elegance of the subject.

In favour of the Fine Arts, we blush not to say that we sometimes relax the academic strictness of our laws. We consider it no disgrace that the first masters of Poetry, Eloquence, and Music, have been heard within our walls; and we cannot blame the taste which has drawn overflowing crowds to listen to the charms of such attractive sounds. Even the most rigid critic, we may be allowed to hope, will not condemn the policy of laying under contribution the pleasures of the lighter Muses to enliven the severer studies of their graver sisters.

Speaking of the Royal Institution as a school of scientific and literary information, the extensive

and well selected Library deserves particular attention. It contains more then twenty thousand volumes of the best authors in all current languages, and is always open for the use of members and subscribers; and as no book is ever permitted to be taken out of the house of the Institution, the visiter is always certain of finding the object of his inquiry. This, likewise, is an extending branch of the establishment: a certain number of books is annually added by purchase, and the list of donations printed in the present Number of this Journal announces that the President, Members, and others, are not unmindful of its increase. The Catalogue drawn up by the Librarian renders its contents easy of access, and adds much to its general usefulness.

Last and (under the shadow of our office we may say it) not least comes our own peculiar department. When first we commenced our career, we proclaimed our wish that an opinion should be formed of the interest and spirit of the undertaking by an inspection of the work rather than upon the suggestions of a prospectus and the promises of an advertisement. The period of probation is accomplished, and we are proud to acknowledge the marked approval of the public voice. If we have succeeded beyond our most sanguine expectations under the disadvantages and diffidence of a first essay, the additional stimulus which we now derive from an established character,

must almost in future command success. While we glory in the encouragement which we derive from the approval of our native country we are scarcely less elated at the distinction which has been conferred upon us by foreign literati. We have been read, quoted, and criticised in all the countries of Europe most distinguished by their scientific attainments, and we may indulge the hope that the field which is thus opened for discussion and liberal criticism in the wide-extended republic of letters, may be highly conducive to the progress of science, and tend to cherish those feelings of acquaintance, benevolence, and respect amongst philosophers of all nations, which it were to be wished could be at all times preserved independant of political relations. The dignity of our national academies precludes any thing of the nature of controversy, much more is it beyond their province to take cognizance of the advancement of science in foreign lands, to canvass speculations, or to attempt to guide opinion. Sparks of truth may be kindled by the collision of genius; and we may hope that the peculiarity of our constitution, which enables us to throw down the gauntlet, will at the same time insure to us dignity and temper in the course which we may have to run. We hail with pleasure the acceptance of the gage by the philosophers of France.

And can it now be a question whether the Royal Institution is to stand? We boldly answer, No.

But while we affirm with confidence the permanence of an establishment which has already done such good service to the state, we must not disguise the difficulties with which we have to contend, nor, like unskilful physicians, cicatrize wounds which we ought to probe. The income of the Society is unfortunately of a fluctuating nature, and depends too much upon fashion and caprice; but whenever the Managers have found it necessary to make an appeal to the liberality of the members, it has always been answered with cheerful alacrity. It may perhaps be said, that in the exercise of their discretion, they were not sufficiently provident, when the tide of fortune flowed in upon them, to fill their reservoirs in anticipation of its ebb. It may be so;—and if there is one circumstance which above all others encourages our best hopes, it is that the expenditure of the last year has been reduced (though but a trifle), within the receipts. The plan adopted for the present year promises a still greater amendment; and we may confidently anticipate the extinction of a part of the debt, (which does not amount to £2300.!) as the first step towards the establishment of a fund which may render our exertions independent of the favours of ephemeral fashion. But it must be remembered, that it is by painful sacrifices and a too rigid œconomy, that we have been enabled to effect this desirable purpose. Our arrears, trifling as they are, clog our exertions; and the hands of the Hercules, who

even in his infant days, has given such promise of future excellence, are bound by a mere spiders' web.

Ought this to be?

If it be true, which all history proclaims, that the prosperity, the riches, the commerce of a country, are indispensably connected with the progress of the Arts and Sciences, we might surely venture an appeal to the Legislature itself. It might possibly be considered as not beneath the dignity of state policy, to consider whether, while it is meting out with no sparing hand, the just reward to those who have raised the country to glory by the arts of war, it might not be right to hold forth some encouragement to others, who have raised the British name at least as high, by pursuits which tend to the civilization and general improvement of mankind. Supposing it, however, to be determined, that the shrine of philosophy should still be left to the exclusive charge of the votaries of the peaceful goddess, can it be deemed worthy of the Government of an enlightened people, that the exertions of individuals, which tend so much to the benefit and exaltation of the nation, should be taxed for the general purposes of the State?*

To the princes of the land, we might also turn

* One of the advantages of the present prospects of the Institution, is the cessation of the tax of 10 per cent. upon its income!

for patronage and encouragement. At the commencement of a new epoch, when the genius of peace has once more returned to her long-forsaken abode upon the earth, what plainer course is open to glory than that of the patrons of arts and sciences. We would remind them in the words of the eloquent Bishop Sprat, of "what reverence all anti-
"quity had for the authors of natural discoveries.
"Their founders of philosophical opinions, were
"only admired by their own sects. Their valiant
"men did seldom rise higher than demi-gods and
"heroes; but the gods whom they worshipped
"with temples and altars, were those who instructed
"the world to sow, to plant, to spin, to build
"houses, and to find out new countries. This zeal,
"indeed, by which they expressed their gratitude
"to such benefactors, degenerated into supersti-
"tion; yet has it taught us that a higher degree
"of reputation is due to discoveries than to the
"teachers of speculative doctrines; nay even to
"conquerors themselves. In the whole history of
"the first monarchs of the world before the flood,
"from Adam to Noah, there is no mention of their
"wars or victories: all that is recorded, is this—
"they lived so many years, and taught their pos-
"terity to keep sheep, to till the ground, to plant
"vineyards, to dwell in tents, to build cities, to
"play on the harp and organ, and to work in brass
"and iron."

The sovereigns of foreign lands are daily offering

new premiums for the advancement of the arts of civilised life, and even establish orders of knighthood for the honourable distinction of civil services; and shall British princes refuse their countenance to the corresponding energies which can alone, in times like these, preserve the proud superiority of their native land?

But should we plead in vain, should our feeble voice be lost amongst the pressing cases of the State, or the bustle of the Court, all turn again with confidence to the source which has never failed us; to the liberality of the British public. Under the shadow of these wings, Science has long been nurtured in this land, and here she will always find shelter and protection. It has ever been the boast of Great Britain, that nearly all that has been done for Science, has been effected by the exertions of individuals. Whether this is at the same time, the justification of her rulers, we will not now inquire. When we look at the splendid list of noblemen and gentlemen, patrons of Science and scientific men, which we this day lay before our readers as members of our Society, we feel certain that the failure of the Royal Institution will never disgrace the present age. Be it remembered, at all events, that we sink not noiseless into oblivion: our fame is gone abroad to all the corners of the earth; and if we fail in the face of the world, our lists will no longer be the register of names which radiate and reflect the glory of this splendid esta-

blishment, but the barren catalogue of those who had not spirit enough to support an Institution which had been so pre-eminently distinguished in the cause of humanity and philosophy.

THE QUARTERLY JOURNAL

OF

SCIENCE AND THE ARTS.

Art. I. *An Enquiry into the Origin of our Notion of Distance. Drawn up from Notes left by the late* Thomas Wedgwood, *Esq.*

Since the publication of Bishop Berkeley's Theory of Vision, it seems to have been unanimously admitted by philosophers, that our visual perceptions undergo, in the progress of experience, an important and extraordinary revolution.

The eye originally perceives only length and breadth, not depth or distance from itself. Some philosophers allow it no other original perception but that of light and colours: the majority, however, have held, that space in two of its dimensions is a primary object of vision.

It has been generally said, that all objects in this original state appear in the same plane. This is an incorrectness naturally arising from the inadequacy of language to the description of this unremembered state of mind, and from the almost inevitable anticipation of terms, which are only significant when they relate to a more advanced stage in the progress of experience. A plane (as Condillac and Reid have observed) implies the existence of a solid, and is not, therefore, a proper term in that state of perception which precedes all notion of solidity. An object removed from the eye must then have appeared only to lessen; and an object placed at different distances from the eye, must have appeared to have different magnitudes, or rather to be different objects.

In process of time we acquire a notion of distance from the eye, or what Berkeley calls outness. We form tolerably correct estimates of what we call the real distances and magnitudes of objects not very remote from us, and we substitute them so instantaneously for the apparent ones, that the mind is unconscious of the change, and mankind in general consider real magnitude and distance from ourselves as direct and primary perceptions of sight. By this great change, which it is impossible for any man who has grown up to maturity, with the use of his senses, fully to conceive, vision becomes so important and comprehensive an inlet of knowledge.

Doctor Berkeley, who first demonstrated the reality of this change, has endeavoured to explain its nature, and his beautiful theory has been received with general assent. Distance and magnitude are, according to his perceptions, acquired by the sense of touch. When we have learned by touch the real magnitude of an object, the visual or apparent magnitude becomes only a sign which instantly suggests the tactual magnitude. As in the case of language, the mind passes over the sign, and attends only to the thing signified. The visual magnitude, which in the primitive state of the human mind was its only object, in the progress of experience entirely vanishes from its notice. It so immediately calls up the tactual magnitude, that what can only be touched appears to us to be seen.

Much of this ingenious theory is undoubtedly true, and was in the time of Berkeley, in the proper sense of the term, a discovery. He first clearly proved the original imbecility and confusion of the sense of sight, and its subsequent acquirements. He showed the instantaneous correction of visual appearances, by notions derived from experience; and he was the first who advanced the important principle, that some perceptions are capable of becoming a language by which other perceptions are represented and suggested. These are additions to the stock of certain knowledge; but that the notions of distance and magnitude are acquired by the sense of touch, will perhaps appear to be doubtful.

It will surely be admitted that touch is altogether incom-

petent to give a notion of colour; but rigidly excluding every idea of colour—what distinct notion can remain of any visual object or of its outness? I can as readily conceive a triangle, which is neither equilateral, nor isosceles, nor scalene, as I can imagine magnitude or figure to exist independent of colour.

Let any one try to consider abstractedly the impression of touch from a point or a ball, and he will find himself utterly unable to divest it of the idea of the figure of the object. If there be then any such quality as tactual magnitude or figure, at least we are ignorant of its nature, since it always occurs united with ideas of sight. This invariable conjunction of the notions of touch and sight prevents our ever ascertaining distinctly their separate properties; hence the one is frequently mistaken for the other; the secondary for the principal. I shall give an instance or two. A person thinks that when his skin is simply cooled, the feeling is different from what he experiences when it is cooled by the application of cold water. Try the experiment. Blindfold him, and put a tin funnel into his hand; fill it gently with water without letting him know that you are doing so; he will observe that his hand is simply cooled. Remove the bandage from his eyes, and hastily pour water into the funnel with such force, that it shall seem to splash over; he will now say that he feels his hand wetted as well as cooled. It is certain that the sensation of touch was the same in both cases, but there was present in the latter a vivid idea of water on the skin, from the imagined dashing over the funnel. It follows, that the supposed difference resulted from the obtrusion of a visual idea in the latter case, which was absent in the former.

On the same principle depends the common experiment of a body seeming double when felt in the angle of the tips of the first and second finger crossed. A person is blindfolded, and desired to attend to the impression of touch from a body so placed: the bandage being removed, he is directed to look at his fingers, while the object is placed as before. He will say, that the first time he felt two bodies at a distance from each other, and that now he feels only one: in his prior experience, if similar sensations occurred on the remote sides of

those two fingers, they had always been occasioned by the contact of two bodies; when he was blindfolded therefore, the idea of the usual visual appearance of two bodies came into his mind, and made him imagine that he touched two bodies; when the bandage was removed, and he saw that there was but one, he immediately perceived that he felt but one. As the sensations of touch from the same impressing body must have been the same in both cases, the supposed difference in them must have been owing to some circumstance of vision: in the first case, the experimenter was deceived by a visual idea; in the second, he was rightly informed by a visual impression.

In the same manner we may conclude that the notions of magnitude and figure, suggested to us by the contact of solid bodies in the dark, are derived from the visual idea of the portions of our skin which are touched by the solid bodies. If we grasp a small body in the dark, we have a visual idea of that portion of the hand which enfolds it: if the whole length of our arm touches the solid body, our judgment of its size is formed from a visual idea of the length of the arm.

But some tactual sensations are not connected with impressions of sight: if these sensations suggest the ideas of magnitude and figure, these qualities must belong to the sense of touch; if they do not suggest them, the fact is nearly decisive of the contrary position. A person ignorant of anatomy, and therefore having no visual ideas of the parts under the skin, would not form any notion of the size or figure of his liver from the sensations of touch, excited through its whole substance by inflammation; but if a scald occasion the inflammation of his finger or of any visible part of the skin, he will have a distinct idea of the size and form of the part affected: we may conclude, then, that this idea is derived from sight, as touch in the preceding instance was found incapable of giving any notion of the size or figure of the inflamed part.

It may be objected that the hand is the proper organ of touch, and that the sensations of the liver are not calculated to impart ideas of magnitude and figure. But the impact of a cube against the hand of a child who has never yet seen his

hand, and the impact of the cube against the coat of the stomach, seem equally incapable of giving any notion of magnitude or figure; and the superiority of the hand above other parts of the body, in suggesting those notions, is owing entirely to the more numerous visual ideas which our habits have connected with it. The hand is indeed the most convenient organ of touch; but if from accident other parts of the body are much exercised in its stead, we find that they acquire much of that delicacy of touch which is usually peculiar to the hand.

Spasms or inflammation will sometimes produce sensations of touch exactly resembling those occasioned by the contact of external objects. An acute spasmodic affection will excite the tactual idea of a point, minute prickly spasms that of numerous points, and a duller diffused spasm that of a curved surface. Suppose that such sensations of touch were experienced by an infant anterior to all impressions of sight, can it be thought that from them he would derive any notion of figure? If he would not, touch is incompetent to suggest the notion of figure; and whenever it seems to introduce that notion into the mind, we may be assured that it has acted a subordinate part.

Touch is equally incompetent to excite the notion of position; if it could suggest position, it must also suggest combined position, and consequently figure; if it gave a notion of the situation of each part of an inflamed liver, it would give an idea of the whole figure.

If a person who has a pain in his back be desired to place his finger on that spot on the back of a statue which corresponds to that which he conceives to be the painful place in his own, he will hesitate long, and at last decide with much uncertainty: but if he turn his head so as to see a bruise on his back, which had been, unknown to him, the source of his pain, he will positively refer the pain to that spot, which will probably differ considerably from the one he had marked on the statue; thus the position is determined by an impression of sight, touch having been found incompetent to ascertain it.

A person who has lost a hand, often fancies that he feels

pain in a finger of that hand, and refers it to that place in the air which his finger would have occupied if he had not lost it. Nothing can more incontestibly prove the inadequacy of the sense of touch to mark position, since the touch or pain is here supposed to suggest its having position in a place where there is no part of the body existing.

I shall now endeavour to show that the idea of distance is acquired by the sense of sight alone, though not originally suggested by it.

For this purpose it will be necessary to enquire into a law of the understanding which, though it must have occurred in some of its modifications to all who have philosophized on the mind, has not been unfolded by any as its importance equires.

The two acts or states of the mind, called perception and idea, have a common nature. I was accustomed some years ago to the view of a street in London, into which my house looked. I now think of the same scene, which I can recall with ease and accuracy. My present notion of it differs from that which entered through the eye only in the superior vivacity and steadiness of the perception over the idea (all considerations of the idea of past time, and of the belief of outward existence, are here intentionally waved). When two perceptions have entered the mind together, or in immediate succession, the recurrence of the idea of one tends immediately to suggest the idea of the other. The same law obtains between perceptions and ideas: when I perceive a small part of an object which I have known familiarly, that perception instantly calls up the idea of all the other parts, and though I only see a part, I think of the whole. The perception and the recollection blend together, so as to form one homogeneous whole. Almost all that seems to be simple perception, is in fact the result of this process. Suppose any object, a chair for example, to be presented frequently to view, and allowed each time to continue in sight for the space of a second: it is plain that each separate perception is the same as that which preceded it, that as a mere perception of the sense the twelfth perception differs nothing from the eleventh, nor the eleventh

from any one that has gone before. Yet the picture of the object, after the first glimpse or two, is confused and faint; after the twelfth time it becomes clear and accurate. Something, therefore, must have coalesced and assimilated with the last perception to render it so much more correct and vivid; and that can only be the ideas, the reproduction or reminiscence of the preceding perceptions. Every perception of the object leaves behind it an idea which instantly coalesces with the subsequent perception. The last perception, blended with all the ideas derived from the antecedent ones, gives a full and distinct notion of the chair. It often happens that the perception is obscure and imperfect, compared with the antecedent kindred ideas; but deriving clearness and completeness from the accession of these, it becomes as useful for all the purposes of reasoning or life as the most perfect perception.

Hence the facility with which familiar objects are recognised. The slightest glance of a horse would give us a distinct idea of his form; but a single fleeting view of a Llama would give us the most imperfect notion of it. The latter perception is of the same duration, and from its novelty perhaps more vivid than the former; but the perception of the horse immediately absorbs, as it were, into itself, the numerous preceding ideas of that animal, or excites the mind to reproduce the past perceptions which blend with the present one; while the perception of the Llama, being conjoined with no antecedent ideas, is left to its own weakness and indistinctness.

Hence the singular acuteness with which men distinguish between objects with which they are particularly conversant. A shepherd will select a particular sheep from the most numerous flock. A seaman will descry a vessel on the bounds of the horizon, discern its size, shape, and rigging, determine of what national make it is, and whether it be for war or commerce, when a landsman, if he see any thing, can discover only a black spot. The shepherd and the seaman may be inferior to other men in their natural powers of sight, exercised upon objects with which they are not peculiarly conversant; but in their own departments they have a store of correct and assimilated ideas, which immediately arise at the call

of the faintest perception, and lend to it their fullness and vivacity. One used, for instance, to finding hares, looks into a brake, and spies part of the head and the tips of the ears of a hare: another person, unaccustomed to field sports, looks on the same spot and sees nothing but the tangling brambles. The optic powers and the actual perception were the same in both persons, but the peculiar shades and contours did not find in the mind of the latter any previous store of ideas, of the form and appearance of a hare, ready to blend with the faintest perception.

The same principle will be found to operate in most of those cases which are usually referred to a greater perfection of sense. The facility of recognition and distinction depends not on better sight, but on better memory, and on a consequent tendency to associate what is remembered with what is seen. Imperfect recognition is the difficulty of blending them.

Why does a painter discern more of the particulars of a picture than a person ignorant of the art? Not from the superior rapidity of examination which he has acquired by habit, for it will still be the case if he does not permit his eye to roll, and at the first glance, when the impression on his eye must be the same with that on the eye of another man, but his mind is filled with a thousand lively ideas which crowd into every picture upon the slightest impulse of association.

Why do we perceive so much more quickly and correctly objects of which we have been in expectation, than others? Because the effect of expectation is to keep up lively ideas of the object expected, which, coalescing immediately with slighter perceptions than would be otherwise noticed, form a complete notion of it.

It is indeed chiefly in consequence of this coalition of idea with impression, that the operations of the mind and the business of human life are carried on with facility and dispatch. If it were not for this law, every view of an external object would be attended with all the labour, and protracted to all the length, of a first examination. Experience would be in a great measure useless, and on every new examination of an

object, we should have to study it as if it were for the first time. But in consequence of this law, the slightest and shortest impression on the senses is sufficient in all familiar cases. The least spark lights up the train of associated ideas. Perception becomes a language, of which the chief use is to excite the correspondent series of thought, and the senses are seldom intensely and long employed but in the examination of new objects. The far greater part of what is supposed to be perception is only the body of ideas which a perception has awakened. If, from particular circumstances, our preconceptions, or those accumulated antecedent ideas, are uncommonly vivid, the slightest incident is sufficient to recall them, and every new impression that bears the remotest similitude to the original, will revive the whole train of sensations: if, for example, a man come to an interview, in very anxious expectation of a friend, he will sometimes for a moment mistake a mere stranger for the expected friend. After living a week in the centre of a deer-park, I took the first flock of sheep I saw for deer. A peasant, whose mind is well stored with tales of ghosts, sees a female figure clothed in white, in a stone or a cow. In these cases the previous ideas modify the perception so as to produce mistake, usually referred to the senses, but which is really referable to the mind. In the approaches, and still more under the influence of insanity, an idea may predominate so strongly as to assimilate to itself every perception to which it bears the most distant resemblance. In Irwin's voyage on the Red Sea, we read of a young man whose mind was so constantly haunted by the dread of assassination by the Arabs, that, looking one day earnestly at the bottom of the boat, he exclaimed, "the darts of the Arabs;" nor could he be convinced that what he saw were merely reeds. Such was the first indication that he gave of mental derangement.

These observations will be sufficient to prove the homogeneousness of perceptions and ideas, and their capacity of being thoroughly blended so as to form one whole. The principle is implied, though not unfolded, in Berkeley's own Theory of Vision, for it supposes the ideas of objects derived from touch

to be excited by the perceptions which enter through the eye, and the idea to be so constantly associated with the perception, that they never can be separated. But its importance deserves that it should be distinctly considered as one of the principal of the secondary laws of thought ; and that importance will appear to be still greater, if I am successful in deducing from it a new and more probable theory of the acquired perceptions of sight.

It has already been said, that superficial distance (or space considered merely in length and breadth,) is an original object of vision. It must indeed be as much so as colour, since it is manifestly inconceivable that we should see unextended colour. Figure is bounded extension ; and these three perceptions, namely, colour, superficial extension, and superficial figure, are the three coeval and inseparable perceptions of sight, which must have entered the mind together on the first exercise of the faculty of vision, and which can never be imagined to exist separate from each other. The generally received doctrine, that distance is not an original object of sight, is ambiguously expressed. As superficial space is an original object of sight, so must the distance between two points which (to borrow an expression from subsequent experience,) are in the same plane ; otherwise one circle would not originally appear larger than another. That which is not an original object of vision, is distance from the eye or outness, and the manner in which we acquire this notion is the object of the present enquiry.

A child has at first no conception that any part of the picture presented to his eyes is composed of his own figure. He views his hand, body, or foot, with the same interest as the trees, stones, &c. He has no idea of sentience connected with one object more than another, nor a thought like what he afterwards acquires, that he is himself present in one part of the picture from which the distances of the rest are measured.

The notion of his person is acquired by observing that sensation is always connected with certain parts of the picture, and that those parts never vary like the others in distinctness, size, colour, &c. His own figure is then made up of a certain

observed portion of the picture, which is a constant uniform unvarying object in every different picture of objects which are unceasingly changing their aspects.

Let us now suppose him to look at his finger, held in that position in which all the parts of it are at nearly an equal distance from the eye. He repeats the observation so often that he acquires a full notion of the superficial distance of all the parts of the finger from each other. Suppose the finger then to be placed somewhat obliquely, the more distant parts of its surface will make a smaller impression on the eye (that is, will subtend a less angle,) than they did before. But the idea of these more distant parts, gained from former observation, will be immediately excited. This idea will correct the impression made on the sense, and thus the more distant parts will seem to be as large as before the finger was moved into an oblique position. When the child has looked often enough at all the parts of his finger, a glimpse of one part of its surface will excite the ideas of all the other parts of it. After a thousand views of the finger in all directions, he never looks at one side without synchronous ideas of the other side; it is hardly observable where impression ends and idea begins. He cannot see the knuckles in a fore-shortened view, without synchronous ideas of the parts interjacent (for they are like the further side of the finger in the preceding case, parts now unseen, but of which there are familiar ideas in the mind,) and he cannot have these ideas of the interjacent parts, without imagining the knuckles at something like their real distance from each other: this gives outness or distance from the eye, which differs from superficial distance only in this respect, that the eye must be considered as one of the points between which space is extended.

A child believes his finger in all views to be the same object, because he never has a new impression of it without some recognised part of a former impression along with it, and also some idea of parts obscure and unseen.

If the more simple parts of this process are distinctly apprehended, there will be no difficulty in conceiving those which are more complicated.

I look at a globe. No more of it than one hemisphere can be the direct object of vision. But I have no separate notion of the hemisphere: I think of the hemisphere I have before seen as soon as I discern the one which I now see. The idea of the invisible part of the globe instantaneously blends with the perception of that which is visible, and they jointly form my notion of the globe.

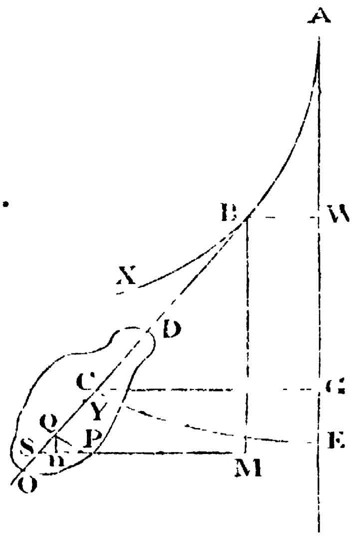
There is a certain distance from the eye at which an object must be placed, in order that it may be most distinctly seen. This is the nearest distance at which the eye can distinctly take in the whole object: when the object is brought nearer, the eye sees only a part of it; when it is removed to a greater distance, the impression on the sense is smaller. This is the largest possible view of the object, and that which leaves behind the fullest and clearest idea of it. This perception is in other respects of such importance, that the mind naturally recurs to it more frequently than to any other. The idea then of the object seen at this distance is in itself the most full and distinct, and is associated with the greatest number of other ideas, as well as with the strongest emotions.

Here then is a visual idea of an object which may be substituted for the tangible magnitude of Berkeley. This idea furnishes what we call the real magnitude of the object. All the other perceptions of the object being comparatively indistinct and uninteresting, are chiefly useful in calling up this idea. Thus a standard visual idea of every object is formed, which instantly blends with every fugitive perception, and corrects it. A visual perception is a sign which excites the standard visual idea, and the whole of that process is performed by the sense of sight alone, for which Berkeley called in the assistance of the sense of touch.

Art. II. *On Pendulums vibrating between Cheeks.* By Benjamin Gompertz, Esq.

The application of a pendulum to the measure of time, has long been considered to be a subject worthy of the attention of the philosopher, and the theory of the vibrating pendulum, has in consequence long been studied by men of science, and has enabled them to present to the world at large, beautiful proofs of the value of mathematical and philosophical researches. But the study of the pendulum does not only offer highly useful information for the common purposes of life, and by that means, bestow convenience on men who unfortunately as well for themselves as for the cultivators of knowledge, are ignorant of any other measure of the value of science, than the scale of interest; but it adds to the intellectual store of the philosopher, property which he alone knows to appreciate, and which is so much the more to be valued, as the intellect of the philosopher is too frequently the only riches he possesses. The great Huygens, in his application of the pendulum to a clock, considering that a body would move through all arcs of the same cycloid whose axis is perpendicular to the horizon in the same time, and knowing the property of describing a cycloid, by unwinding a string of a certain length from another cycloid, conceived the idea of constructing tantochronic pendulums, or such as will complete their vibrations, whether great or small, in the same time, by causing pendulums during their vibrations to bend about and unbend from cycloids called cycloid cheeks; many have since attempted to reap the benefit of this theory; but difficulties have been found in the mechanical execution of it; and it is my object in the sheets I have now the honor to lay before the public, to consider the real effect of cheeks about which pendulums are required to vibrate, when such pendulums are not considered to be different from their real nature, or in other words, when they are not considered to be points.

Fig. 1.



PROBLEM I.

The body PCDQS vibrates in a vertical plane, being hung on a thread ABD, which as the body vibrates, winds about the curve ABX; and it is here proposed to determine the circumstances relating to the motion, proper data being supposed given. *The part* BD *below the point where the thread leaves the curve, being supposed a right line passing through the centre of gravity C of the body,* the resistance of the air not being taken into consideration?

Let v be the velocity at a certain time of a particle P of the body, in the direction PM parallel to the horizon; let u be the velocity at the same time of the same particle P, in the direction parallel to BM, which is perpendicular to the horizon; and let $2g$ be the absolute force of gravity, consequently $P\dot{v}$ is the fluxion of the momentum generated in P by the inertia of the system in the direction PM; and $\dot{t}$ representing the fluxion of the time $\dot{u}P - 2gP\dot{t}$ will represent the fluxion of the momentum generated in P in the direction BM by the inertia of the system; but because the system by its inertia cannot put itself in motion or destroy any motion which it might have, it follows that the whole of these forces in the system must destroy each other. Furthermore, supposing B

the point at this instant where the thread ABX leaves the cheek; this point B will be the momentary centre of motion about which all the particles revolve, and through the medium of which, as a fulcrum, the effect of any particle P may, by the power of the lever, be transferred to any point C of the body; and consequently by the property of the lever, because the above named forces destroy each other, we have I, the sum of $(\dot{v} . P . BM)$ + the sum of $(\dot{u}\, P - 2\, g\, P . \dot{t} . MP) = o$. Draw PQ I BC cutting $\dot{u}$ in Q, produce PM to cut BD in S, and draw $Qn \perp SM$, cutting SM in n; therefore $PM = BQ$. cos of the angle BSM — PQ × sine of the angle BSM: and if V be the absolute velocity of the centre of gravity C of the body, it is evident we should have, whilst B is the momentary centre, BC:V::BM: the velocity of M or its equal the velocity of P in the direction PM that is v; and therefore $BM = \frac{BC}{V} . v$; also we have $BC:V::PM:u$; and consequently $PM = \frac{BC . u}{V}$, consequently equation I becomes sum of $\frac{v\dot{v} . BC}{V} P)$ + sum of $\left(\frac{u\dot{u} . BC}{V}\right) . P - 2g.P. \dot{t} . MP) = o$; and ∴ II; sum of $v\dot{v}\, P$ + sum of $u\dot{u}\, P$ = sum of $2g\, P\, \dot{t}\, V . \frac{MP}{BC}$; but sum $v\dot{v} . P + u\dot{u}\, P = \frac{1}{2}$ fluxion of sum of $(v^2 . P + u^2\, P =$ $\frac{1}{2}$. fluxion of sum of $\left(\frac{V^2 . BM^2 . P}{BC^2} + \frac{V^2 . PM^2 . P}{BC^2}\right) =$ $\frac{1}{2}$. fluxion of sum of $\frac{V^2 . BP^2}{BC^2} = \frac{1}{2}$. fluxion of $\left(V^2 .\right.$ sum of $\left.\frac{BP^2}{BC^2}\right) =$ (because C is the centre of gravity of the body, and supposing a be put for the sum of $\frac{CP}{BC^2} . P$ in the body, and the body be called 1,) $\frac{1}{2}$. fluxion of $\overline{\left(1 + \frac{a}{BC^2}\right) V^2}$; also sum of $2\dot{g} . P\dot{t} . V . \frac{PM}{BC}$ = (by substituting for PM its value BQ . cos of BSM — PQ . sine of BSM found above) $2g\, \dot{t}$ cos of BSM . V; because C is the centre of gravity and in consequence sum of $BQ . P = BC$, the body being 1 and the sum of $PQ = o$.

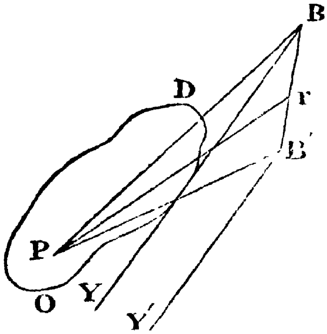
Hence equation II becomes III, fluxion of $1 + \frac{a}{BC^2} \cdot V^2 = 4g\,\dot{t} \cdot V$ cos of S. Let AE cutting the path CE of the centre of gravity C of the body, in E, be a line given in position $\perp$ to the horizon; draw CG parallel to the horizon cutting AE in G, put $EG = x$ $GC = y$ $EC = z$ $R = BC$; and consequently because BC is perpendicular to the curve CE at C, the cosine of the $<$ S or its equal the cosine of $BCG = \frac{\dot{x}}{\dot{z}}$, and $\dot{t}$ is $= \frac{\dot{z}}{V}$ whilst C descends; consequently the equation III becomes fluxion of $\left(\overline{1 + \frac{a}{R^2}}.V^2\right) = -4g\dot{x}$, and therefore $\overline{1 + \frac{a}{R^2}}.V^2 = 4g \,.\, \overline{b - x}$, b being the value of x when $V = o$, consequently

$$V = \sqrt{4g \,.\, \frac{b-x}{1+\frac{a}{R^2}}} \text{ and } \dot{t} = -\frac{\dot{z}}{\sqrt{4g \,.\, \frac{b-x}{1+\frac{a}{R^2}}}}$$

We might here proceed in the subject in hand; but as I am not aware that any one has gone before me in this speculation, I consider it more satisfactory to have the corroborative evidence of a second investigation, and for this object I shall propose the following Lemma, which will be found worthy of consideration for other purposes as well as for this now in view.

Lemma. If a body OPD, fig. 2. after having been put in motion, move in virtue only of its inertia, and by some mechanism is continually changing its centre of motion, by continued and gradual, or in other words not sudden change, then I say the velocity of the centre of gyration of the body, corresponding to the point about which it may then be revolving, will be a constant quantity; that is the same as the velocity of any other point in the body, at the time when it is the centre of gyration, corresponding to the point about which it is at this other time revolving.

Fig. 2.



Let B be the centre about which the body is revolving at a certain instant, B′ infinitely near B be the centre about which it revolves the next instant, bisect BB′ in r, and from every point P of the body, draw PB, Pr and PB′, let w be the angular velocity of the body in the first instant, measured at the distance 1, and the momentum of P will be $w \cdot P \cdot PB$ when it revolves about B, which is divisible into two, the one in the direction B′P, and the other perpendicular thereto, and which is $= w \cdot P \cdot PB \cdot \cos$ of the angle BPB′, or omitting quantities infinitely small of the second degree simply $w \cdot P \cdot PB$ the former of these forces when B′ becomes the centre is destroyed by the reaction of B′, and the other gives to P the angular momentum $w \cdot P \cdot PB \cdot PB' = w \cdot P \cdot Pr^2$, neglecting infinitely small quantities of the second degree, consequently the whole angular momentum of the body $= w$ sum of $(P \cdot Pr^2)$; Let Y be the centre of gyration of the body when it revolves about B, and Y′ the centre of gyration of the body when it revolves about B′, consequently, $BY^2 = \frac{\text{sum of } BP^2 \cdot P}{\text{body}} =$, neglecting infinitely small quantities of the second degree, (Sum of $Pr^2 \cdot P$ + sum of (2 $Br \cdot Pr \cdot P$ cos of r)) $\div$ body $=$ (sum of $(Pr^2 \cdot P)$ + 2 Br . sum of $Pr \cdot P$. cos of r)) $\div$ body: in the same way we find $B'Y'^2 =$ (sum of $(Pr^2 \cdot P) - 2 \cdot Br$. sum of $Pr \cdot P$. cos of r)) $\div$ body; $\therefore B'Y'^2 \cdot BY^2 = (\overline{\text{sum of } Pr^2 \cdot P}|^2 - 4\, Br^2 \cdot (\overline{\text{sum of } Pr \cdot P \cdot \cos \text{ of } r}|^2) \div \overline{\text{body}}|^2$; or neglecting the term of which Br^2 is the coefficient, it being infinitely small of the second degree, we find $B'Y'^2 \cdot BY^2 = \frac{\overline{\text{sum of } Pr|^2 P}|^2}{\text{body}}$;

$\therefore$ B′Y′ . BY $= \frac{\text{sum of } Pr^2 . P}{\text{body}}$; consequently the angular momentum of the body which was above shown to be w. sum of P Pr^2 is equal to w. body $\times$ B′Y′ . BY, when the body revolves about B′; and Y′ being the centre of gyration corresponding, the velocity of Y′ will be the said angular force divided by B′ Y′. into the body, and is consequently w. BY or the velocity which Y had when the body revolved about B, and therefore, the fluxion of the velocity being equal to nothing the velocity is constant QED. The above is not the only proof the lemma admits of, and the truth is likewise corroborated by the principal of vis-viva.

Hence to a second solution of the Problem. See Fig. 1.

Let O be the centre of oscillation, and Y the centre of gyration of the body corresponding to the centre of suspension B; $\therefore$ the velocity of Y $= V. \frac{BY}{BC} =$ by the known expression for the distance of the centre of gyration from the point of suspension) $V. \sqrt{\frac{BO}{BC}} = V. Q$, Q being put for $\sqrt{\frac{BO}{BC}}$; $\therefore$ from the lemma were it not for gravity we should have V. Q a constant quantity, or $\dot{V}Q + V\dot{Q} = o$; that is $\dot{V} = -\frac{\dot{Q}V}{Q}$, and consequently the excess of the real value of $\dot{V}$ above this value, must be generated by gravity: but gravity would generate in C, the velocity $2g\dot{t}$. cos of C . $\frac{BC}{BO}$ that is $-\frac{2g\dot{x}}{V . Q^2}$:

$$\therefore \dot{V} + \frac{Q\dot{V}}{Q} = -\frac{2g\dot{x}}{V . Q^2}, \text{ and therefore } V\dot{V}Q^2 + \dot{Q}Q . V^2 =$$

$-2g\dot{x}$; and $\therefore V^2 Q^2 = 4g . (b-x)$ and $V = \sqrt{4g . \frac{b-x}{Q^2}} =$

$\sqrt{4g . \frac{b-x}{1 + \frac{a}{R^2}}}$ the same as before.

And consequently when the curve described by C is given, the time describing any part of it may be formed; but it may be more convenient in case the cheek ABX fig. 1, is

given to have the expression of time immediately from that, in order to which, put AB $= Z$, AW $= X$, BW $= Y$, AE $= c$; $\therefore$ BC $= c - Z$, and cosine of $<$ BCG $= \frac{\dot{x}}{\dot{z}}$, and likewise $= \frac{\dot{Y}}{\dot{Z}}$; and $\therefore \dot{z} = \dot{Z} \times \frac{\dot{x}}{\dot{Y}}$; also x or AE $-$ AW $-$ WG $=$ $c - X - (c - Z)\frac{\dot{X}}{\dot{Z}}$; $\therefore \dot{x} = -\dot{X} - (c - Z) \cdot \frac{\ddot{X}\dot{Z} - \dot{X}\ddot{Z}}{\dot{Z}^2}$ $+ \dot{X} = -(c - Z)\frac{\ddot{X}\dot{Z} - \dot{X}\ddot{Z}}{\dot{Z}^2} \therefore \dot{t} = (c - Z) \cdot \frac{\ddot{X}\dot{Z} - \dot{X}\ddot{Z}}{\dot{Y}\dot{Z}} \div$

$$\sqrt{4g^2 \frac{b - c + X + (c - Z)\frac{\dot{X}}{\dot{Z}}}{1 + \frac{a}{\overline{c - Z}|^2}}} = \frac{\left(\overline{c - Z}|^2 + a\right)^{\frac{1}{2}} \cdot \frac{\ddot{X}\dot{Z} - \dot{X}\ddot{Z}}{\dot{Y}\dot{Z}}}{\sqrt{4g \cdot \left(b - c + X + (c - Z)\frac{\dot{X}}{\dot{Z}}\right)}}$$

in which one of the two $\dot{X}$, $\dot{Z}$ may be taken constant.

If the equation of the cheek is $eX = eZ - Z^2$ it will be a cycloid convex to the horizon passing through A, whose axis is perpendicular to the horizon, the diameter of its generating being $\frac{1}{4}e$; and we shall have $\dot{X} = \dot{Z} - 2\frac{Z\dot{Z}}{e}$, $\therefore \frac{\dot{X}}{\dot{z}} = 1 -$ $2\frac{Z}{e}$, $\frac{\ddot{X}\dot{Z} - \ddot{Z}\dot{X}}{\dot{z}} = -2\frac{\dot{Z}^2}{e}$, $\dot{Y} = \dot{Z}\sqrt{4\frac{Z}{e} - 4\frac{Z^2}{e}}$, consequently

$$\dot{t} = \frac{\left((c - Z)^2 + a\right)^{\frac{1}{2}} \times -\dot{Z} \cdot e\,\overline{Z - Z^2}|^{-\frac{1}{2}}}{\sqrt{4g\left(b - c + Z - \frac{Z^2}{e} + \overline{c - Z} \cdot \overline{1 - 2\frac{Z}{e}}\right)}} =$$

$$\frac{\left((c - Z)^2 + a\right)^{\frac{1}{2}} \times -\dot{Z}}{\sqrt{4g \cdot \left(b - 2\frac{c}{e}Z + \frac{Z^2}{c}\right)}\sqrt{eZ - Z^2}},$$ or because $eZ - Z^2 = eX$,

$Z = \frac{1}{2}e - \sqrt{\frac{1}{4}e^2 - eX}$ and $\dot{Z} = \frac{\frac{e}{2} \cdot \dot{X}}{\sqrt{\frac{1}{4}e^2 - X}}$ we have $\dot{t} =$

$$\frac{\sqrt{a+\left(c-\frac{1}{2}e+\sqrt{\frac{1}{4}e^2-eX}\right)^2}\times-\frac{e}{2}\frac{\dot{X}}{\sqrt{eX}\sqrt{\frac{1}{4}e-X}}}{\sqrt{4g\left(b-X+\frac{e-2c}{e}\times\left(\frac{1}{2}e-\sqrt{\frac{1}{4}e^2-eX}\right)\right)}},$$

because $-\frac{2cZ}{e}+\frac{Z^2}{e}=-Z+Z^2+\frac{e-2c}{e}.Z$, and if t represent the time of one half vibration, the fluent will be to be taken between the limits of $\overline{b-X+\frac{e-2c}{e}\times\frac{1}{2}e-\sqrt{\frac{1}{4}e^2-eX}}$ being $=o$ and $=b$. If a and $e-2c=o$ this becomes the usual case of the cycloid, and $\dot{t}$ becomes $=$ $\frac{-\frac{e}{2}.\dot{X}}{\sqrt{4g.e\,(bX-X^2)}}$ and the fluent will be to be taken between the limits $X=b$ and $=o$, this will evidently give tantochronism for all values of b, as b will not enter, but in the true case of the problem, the thing is different. I believe a more convenient form would be obtained by putting $2cZ-Z^2=\varrho$ which by the bye is $=ex$, and supposing $Z=o$ when $\varrho=o$: which gives $Z=c-\sqrt{c^2-\varrho}$, the negative sign being necessarily prefixed to the radical quantity in order to fulfil the condition of $Z=o$ when $\varrho=o$; this gives $\overline{c-Z}|^2=c^2-\varrho$ $\therefore\dot{Z}=\frac{\frac{1}{2}\dot{\varrho}}{\sqrt{c^2-\varrho}}$, and putting $h=e-2c$, $eZ-Z^2=2cZ-Z^2+hZ=\varrho+h.(c-\sqrt{c^2-\varrho})$, and consequently $\dot{t}=$

$$\frac{\sqrt{c^2-\varrho+a}\times-\frac{1}{2}\dot{\varrho}\,\overline{c^2-\varrho}|^{-\frac{1}{2}}}{\sqrt{4g.\overline{b-\frac{\varrho}{e}}|}\sqrt{\varrho+h.(c-\sqrt{c^2\varrho})}}.$$

If we suppose c great in comparison to ϱ, $c-\sqrt{c^2-\varrho}$ may be written $\frac{1}{2}\frac{\varrho}{c}+\frac{\varrho^2}{2.4.c^3}+\frac{3\varrho^3}{2.4.6.c^5}$, &c., and therefore $\varrho+h.(c-\sqrt{c^2-\varrho})=$

$\frac{1}{2}\cdot\frac{e}{c}\varrho+\frac{h\varrho^2}{2.4.c^3}+\frac{3h\varrho^3}{2.4.6.c^5}$ &c. and therefore $\left(\varrho+h.\left(-c\sqrt{c^2-\varrho}\right)\right)^{-\frac{1}{2}}$

$$=\frac{1}{\sqrt{\frac{1}{2}\frac{e}{c}\cdot\varrho}}\times\overline{1+\frac{h\varrho}{4c^2e}+\frac{3h\varrho^2}{4.6.c^4e}\text{ \&c.}}\Big|^{-\frac{1}{2}}=\frac{1}{\sqrt{\frac{1}{2}\frac{e}{c}\varrho}}$$

$$\times\left(1-\frac{h\varrho}{2.4.e.c^2}-\left(\frac{3h}{2.4.6\ e.c^4}.-\frac{1\ 3.h^2}{2.4.16.e^2.c^4}\right)\varrho^2\text{ \&c.}\right);$$ also

$$\sqrt{c^2-\varrho+a}\times(c^2-\varrho)^{-\frac{1}{2}}=\sqrt{1+\frac{a}{c^2-\varrho}}=\sqrt{1+\frac{a}{c^2}\times\left(1+\frac{\varrho}{c^2}+\frac{\varrho^2}{c^4}\text{\&c.}\right)}$$

$$=\sqrt{1+\frac{a}{c^2}}\times\sqrt{1+\frac{a}{c^2+a}.\times\frac{\varrho}{c^2}+\frac{\varrho^2}{c^4}\text{\&c.}}\Big|-\sqrt{1+\frac{a}{c^2}}+\frac{1}{2}$$

$$\cdot\frac{a}{c\sqrt{c^2+a}}\cdot\frac{\varrho}{c^2}+\left(\frac{1}{2}\frac{a}{c\sqrt{c^2+a}}-\frac{1}{2.4}\cdot\frac{a^2}{c.\overline{c^2+a}|^{\frac{3}{2}}}\right)\frac{\varrho^2}{c^4}$$ &c. consequently

$$\dot{t}=-\frac{\frac{1}{2}\dot{\varrho}}{\sqrt{\frac{2g}{c}(be\cdot\overline{\varrho-\varrho^2})}}\times$$

$$\left\{\begin{array}{l}\sqrt{1+\frac{a}{c^2}}+\frac{\frac{1}{2}a}{c\sqrt{c^2+a}|}\\ \qquad-\frac{h}{2.4.e}.\sqrt{1+\frac{a}{c^2}}\end{array}\right\}\cdot\frac{\varrho}{c^2}$$

$$\left\{+\left\{\begin{array}{l}\left(\frac{\frac{1}{2}a}{c\sqrt{c^2+a}}-\frac{1}{2.4.c}\cdot\frac{a^2}{\overline{c^2+a}|^{\frac{3}{2}}}\right)\\ \qquad-\frac{h.a}{2.2.4.ec\sqrt{c^2+a}}\\ \quad-\sqrt{1-\frac{a}{c^2}}\left(\frac{3h}{2.4.6.e}-\frac{3h^2}{2.4.16.e^2}\right)\end{array}\right\}\cdot\frac{\varrho^2}{c^4}\text{\&c.}\right\}$$

or putting $\frac{1}{2}\frac{\sqrt{1+\frac{a}{c^2}}}{\sqrt{\frac{2g}{c}}}=A$; and B, C &c. for the above co-

efficients of ϱ, ϱ^2 &c. when multiplied by $\frac{2}{\sqrt{2g}}$ we have $\dot{t} =$

$\frac{\dot{\varrho}}{\sqrt{be\varrho - \varrho^2}} \times \overline{A + B\varrho + C\varrho^2 + \&c.}$; and the whole fluent of this between the limits of $\varrho = bc$ and $\varrho = o$ being the time of one half vibration, is $p \times (A + \frac{1}{2} B \,.\, be + \frac{1.3}{2.4} C \,.\, b^2 e^2$ &c.) p standing for the semiperiphery of a circle whose radius is unity.

Here we observe that A, B, C do not contain b; and therefore that in the usual case of the cycloid; that is when the vibrating body is considered to be a point, and the length of the cycloid cheek reckoning from A to the diameter of the cycloid, is equal to the length of the pendulum; B, C, &c. will be equal to o; and we shall consequently have t the same whatever b is; but when B, C, &c. are not equal to o tautochronism is not produced by the cycloid cheek, and this being the real case of nature, we see no reason why the cycloid cheeks should be used for the purpose for which they were invented. Here, however, it is necessary to remark, that in the enunciation of the problem to which we have now been giving a solution, it is required that the part BD below the point where the thread leaves the curve shall be a right line passing through the centre of gravity C of the body, but whether that would be the case in Huygens' construction, does not interfere with this solution, and a mechanical construction might be given to produce the effect: indeed I shall show further on, that the common construction would not admit of it, and that in consequence a point in the pendulum which may have, according to that construction, been supposed to describe a cycloid, does not. Retaining the enunciation of the problem, I observe that we have the power of choosing such a cycloid cheek that B may vanish, that is by taking $\dot{a} = \frac{h}{4 \,.\, e} \,.\, (c^2 + a)$ that is $= \overline{1 - 2\frac{c}{e} \,.\, \frac{c^2 + a}{4}}$, and $\therefore e =$

$\frac{c^2+a}{c^2-5a} \cdot 2c$; by this means, when the arc of vibration is small, it is plain that this cycloid cheek would answer better than a centre, but other curves might be found to answer the same purpose, and better; it is further worthy of remark, that this cycloid is not the same as would suit a pendulum, considered to have the matter concentrated in the centre of oscillation corresponding to the full length of our pendulum, for that would require e to be $= \overline{1+\frac{1}{a}} \cdot 2c$. This remark may interfere with the determination of the length of a pendulum for universal measure, a subject of present public consideration.

But as the subject of tautochronism is an object interesting to the scientific man and to the public at large, and has been long a favorite topic of the mathematician, I presume, that having shown that the cycloid cheek which has, I believe, hitherto been considered, the proper means of attaining it, independent of the resistance of the air, does by no means accomplish the end, the analyst will not object to peruse the following investigation of the true curve the centre of gravity of a body ought really to describe for that purpose under the restrictions of Problem I., and for this end I shall propose by way of Lemma the investigation of an analytical problem which may be found useful in other purposes, and which is something more general than is required for our present object.

PROBLEM II.

" Having $\dot{A} = \dot{u} \cdot \overline{b-x}|^p$ it is proposed to find u a function of x, such that A may be $= o$ when $x = b$; and $A = k$ when $x = o$: b and p being constant quantities, k and u independent of b, and the sum of the infinite series $\frac{1}{p+1} + \frac{p+1}{p+2} + \frac{\overline{p+2}}{2} \cdot \frac{p+2}{p+3} + \frac{\overline{p+1} \cdot \overline{p+2} \cdot \overline{p+3}}{2 \cdot 3 \cdot \overline{p+4}}$ &c. finite?

Solution. Suppose $\dot{u} = \dot{x} f(x)$; f standing for the characteristic of an operation or function to be found: then because $x = b -$

$(b-x)$, $\dot{u} = \dot{x} f(b-(b-x)) = \dot{x} f(b) - (b-x)\, \dot{x} f'(b) + (b-x)^2\, \dot{x}$ $f''(b)$ &c.; f', f'' &c. being characteristics of functions; therefore

$\dot{A} = \dot{x} f(b) . \overline{b-x}|^{p} - \dot{x} f'(b) . (b-x)^{p+1} + \dot{x} f''(b) . (b-x)^{p+2}$

&c.; and $A = -f(b) . \frac{\overline{b-x}|^{p+1}}{p+1} + f'(b) . \frac{\overline{b-x}|^{p+2}}{p+2} -$ $f''(b) . \frac{\overline{p-x}|^{p+3}}{p+3}$, &c. which according to the requisite of the problem as A is $= o$ when $x = b$ does not require correction; therefore when $x = o$ A which is then to be $= k$ is

$= -f(b) . \frac{b^{p+1}}{p+1} + f'(b) . \frac{b^{p+2}}{p+2} - f''(b) . \frac{b^{p+3}}{p+3}$

&c. we have now to obtain the characteristic f, so that b vanishes from this equation, and we immediately perceive that we have only to take $f(b) = e . b^{-p-1}$, e being independent of b, this evidently makes b vanish from the first term of the right hand side of this equation, and from Taylor's Theorem it is known that if $f(b) = e . b$, that $f'(b) = -e . \overline{p+1} . b^{-p-2}$, $f''(b) = e . \frac{\overline{p+1} . \overline{p+2}}{2} . b^{-p-3}$, and that consequently the above value of k is $= -e . \left(\frac{1}{p+1} + \frac{p+1}{p+2} + \frac{p+1}{2} . \frac{p+2}{p+3} \&c.\right)$ and $\therefore e = \dfrac{-k}{\frac{1}{p+1} + \frac{p+1}{p+2} + \frac{p+1}{2} . \frac{p+2}{p+3} \&c.}$. But if $f(b) = eb^{-p-1}$, then $f(x) = e . x^{-p-1}$ and $\therefore \dot{u} = e\dot{x} . x^{-p-1}$ and $\therefore u = n - e\frac{x^{-p}}{p}$ n being a constant quantity QEI.

As the demonstrations of our result will be to many easier to follow than the above investigation, I shall insert it; it is as follows:

u being $= n - \frac{ex^{-p}}{p}$ it follows that $\dot{A} = e\dot{x} . x^{-p-1} \overline{b-x}|^{p}$; put $b-x = y$, and $\therefore \dot{A} = -e\dot{y} y^{p} \overline{b-y}|^{-p-1} = yeb^{-p-1} \dot{y} y^{p}$

$\times (1 + \overline{p+1} \cdot \frac{y}{p} + \frac{p+1}{1} \cdot \frac{p+2}{2} \cdot \frac{y^2}{b^2} +$ &c.) and therefore

$A = -eb^{-p-1} \times \left(\frac{y^{p+1}}{p+1} + \frac{p+1}{p+2} + \frac{y^{p+2}}{b} + \frac{p+1}{2} \cdot \frac{p+2}{p+3} \cdot \right.$

$\left. \frac{y^{p+3}}{b^2} \text{ &c.} \right)$ requiring no correction, because it gives $A = o$ when $x = b$ that is when $y = o$; and consequently when $x = o$ that is when $y = b$, $A = -e \times \left(\frac{1}{p+1} + \frac{p+1}{p+2} + \frac{p+1}{2} \cdot \frac{p+2}{p+3} \text{ &c.} \right)$ that is substituting for the value of e its value given above, $= k$, QED. Hence the solution of Problem III.

Required the path described by the centre of gravity C of the body PCDQ, see fig. 1, moving as represented in Problem I. (the cheek ABX being not given, but depending on the nature of the required path) such that the vibrations may be tautochronic?

Solution. Because from Problem I. $\dot{t} = \frac{-\dot{z}}{\sqrt{4g \cdot \frac{\overline{b-x}}{1 + \frac{a}{R^2}}}}$ we have to find the nature of the curve such that t may be $= o$ when $x = b$. and t, for instance equal to k when $x = o$ whatever b may be; comparing this with the last problem we have $A = t$, $\dot{u} = -\frac{\dot{z}}{\sqrt{4g}} \sqrt{1 + \frac{a}{R^2}}$ and $\dot{A} = \dot{u} \cdot \overline{b-x}^{-\frac{1}{2}}$ $\therefore p = -\frac{1}{2}$ and the series $\frac{1}{p+1} + \frac{p+1}{p+2} + \frac{p+1}{2} \cdot \frac{p+2}{p+3}$ &c. $= \frac{2}{1} + \frac{1}{3} + \frac{1.3}{4.5} + \frac{1.3.5}{4.6.7} + \frac{1.3.5.7}{4.6.8.9}$ &c. or half the circumference of a circle whose radius is unity $= 3,14159$ &c. and, therefore, by the last problem

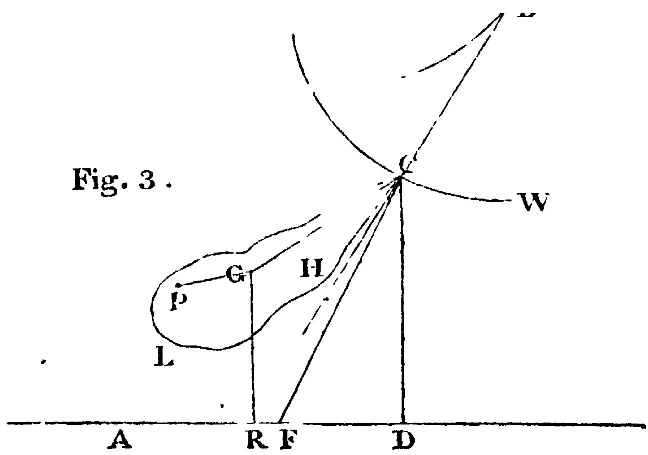
$\dot{u} = -\frac{k}{3,14159, \text{ &c.}} \times \dot{x}x^{-\frac{1}{2}}$, and therefore the equation of

the curve putting $\frac{k\sqrt{4g}}{3.14159 \text{ &c.}} = \sqrt{d}$, is $\sqrt{\frac{d}{x}}\, \dot{x} = \dot{z} \sqrt{1 + \frac{a}{R^2}}$

in which if $\dot{x}$ be constant R is equal to $-\frac{\dot{z}^3}{\dot{x}\ddot{y}}$. If the vibrating

body be but a point, a will be equal to o, and we shall then have $\sqrt{\frac{d}{x}}\,\dot{x} = \dot{z}$ which is the equation to the cycloid. In what has gone before, I have supposed by the effect of mechanical construction if necessary, the part BD below the point where the thread leaves the cheek to be a right line passing through the centre of gravity of the body; because the received theory of the pendulum vibrating between cycloid cheeks is derived from certain notions connected with the requisite, that the weight does not move about the point D, where it is fastened to the thread; mechanical constructions might be pointed out which would answer this requisite in theory, and we have above shewn, that that requisite being accomplished, still the received theory of the vibrating pendulum moving between cycloid cheeks, if the body have any magnitude, as in nature it must have, would not be correct, there therefore appears to me an interesting enquiry with regard to this subject, which is, whether Huygens' construction without other mechanical contrivance, namely, if the weight be merely hung between the two cheeks by a silken thread bending about them would in its vibrations have the property of not moving about D as a centre? the consideration of this enquiry now follows, G being the centre of gravity of the body whose point C moves in the groove or line. CW.

Fig. 3.



Let $CG=a$, $AR=x$ $RC=y$ $AD=X$, $DC=Y$, ARD being a right line parallel to the horizon, and GR, CD lines perpendicular thereto; t the time from the commencement of the motion; v the velocity of the centre of gravity G of the body in the direction AR, u the velocity thereof in the direction GR: ϱ the velocity of C in the direction CD, σ the velocity of C in the direction AD; M the reaction of the groove or line CW in the direction CD, N the reaction of the groove in the direction AD, g the accelerative force of gravity in one second of time. Here it is to be observed, that if BC bends about a given cheek, as long as the part of the thread BC below the cheek is a straight line, so long the point C will be found in a determinable line CW an involute of the cheek, and that instead of the thread and cheek we may suppose as I here do, the point C to move merely in a groove CW. Now if it were not for the reaction M of the groove, the fluxion of u would be $g\dot{t}$, instead of which it is $\dot{u}$; ∴ I; $\dot{u}-g\dot{t} =$ (the action of the groove in the direction $CD = M\dot{t}$: again, the whole force on G parallel to AD is N; ∴ II; $\dot{v}=N\dot{t}$. Again, the part of M which acts perpendicularly to GC to accelerate the velocity of C about G in the order CHL is $= M \times$ sine of $GCD = \frac{X-x}{a}M$; and the part of the force N which acts at C perpendicularly to CG to have the same effect is $=$ N cosine of $\angle\, GCD = \frac{Y-y}{a}.N$, and consequently the whole force to accelerate the velocity of C about G is a force at $C = \frac{X-x}{a}.M + \frac{Y-y}{a}.N$; but the velocity of C $\perp$ CG is $= \varrho.$ sine of $GCD + \sigma.$ cosine of $GCD = \varrho . \frac{X-x}{a} + \sigma . \frac{Y-y}{a}$; and the velocity of G $\perp$ $CG = u . \frac{X-x}{a} + v . \frac{Y-y}{a}$; consequently the velocity of C about $G = \overline{\varrho - u} . \frac{X-x}{a} + \overline{\sigma - v} . \frac{Y-y}{a}$; and therefore putting $b =$ sum of $\frac{GP^2 . P}{CG^2}$, P being a particle of the

body, we have III; $\overline{\frac{X-x}{a}.M+\frac{Y-y}{a}.N}\times\dot{t}=b\times$ fluxion of $\left(\overline{\varrho-u}.\frac{X-x}{a}+\overline{\sigma-v}.\frac{Y-y}{a}\right)$. Moreover the absolute reaction of C is in the direction perpendicular to the groove; consequently, if FC is perpendicular to the groove we shall have IV; (the tangent of the $<$ FCD $=$) $-\frac{N}{M}$ (and likewise) $=-\frac{\dot{Y}}{\dot{X}}$; also V; $\dot{t}=\frac{\dot{x}}{v}=-\frac{\dot{y}}{u}=\frac{\dot{X}}{\sigma}=-\frac{\dot{Y}}{\varrho}$; $\therefore\ \varrho-u=\frac{\dot{y}-\dot{Y}}{\dot{t}}$; $\sigma-v=\frac{\dot{X}-\dot{x}}{\dot{t}}$; fluxion of $(\overline{\varrho-u}.\frac{X-x}{a}+\overline{\sigma-v}.\frac{Y-y}{a})$ $=$ fluxion of $\left(\frac{\dot{y}-\dot{Y}}{\dot{t}}.\frac{X-x}{a}+\frac{\dot{X}-\dot{x}}{\dot{t}}.\frac{Y-y}{a}\right)=\frac{\ddot{y}-\ddot{Y}}{\dot{t}}.\frac{X-x}{a}+\frac{\ddot{X}-\ddot{x}}{\dot{t}}.\frac{Y-y}{a}=\left(\frac{\ddot{Y}-\ddot{y}}{\dot{t}}.\frac{\dot{Y}-\dot{y}}{a}+\frac{\ddot{X}-\ddot{x}}{\dot{t}}.\frac{\dot{X}-\dot{x}}{a}\right)\times\frac{Y-y}{\dot{X}-\dot{x}}$; because in consequence of the equation $\overline{X-x}|^2+\overline{Y-y}|^2=a^2$, it follows that $\overline{\dot{X}-\dot{x}}.\overline{X-x}+\overline{\dot{Y}-\dot{y}}.\overline{Y-y}=o$; consequently Equation III. becomes VI; $M\dot{t}.\overline{X-x}\frac{\dot{X}-\dot{x}}{Y-y}+N\dot{t}.\overline{\dot{X}-\dot{x}}$ or its equal $-M\dot{t}.(\dot{Y}-\dot{y})+N\dot{t}.\overline{\dot{X}-\dot{x}}=\frac{b}{2}$. fluxion of $\left(\overline{\frac{\dot{X}-\dot{x}}{\dot{t}}}\Big|^2+\overline{\frac{\dot{Y}-\dot{y}}{\dot{t}}}\Big|^2\right)$; but from equation IV; $-M\dot{Y}+N\dot{X}=o$ from equation I; $M\dot{t}=\dot{u}-g\dot{t}=-\frac{\ddot{y}}{\dot{t}}-g\dot{t}$; and from equation II; $N\dot{t}=\dot{v}=\frac{\ddot{x}}{\dot{t}}$; therefore equation VI. becomes $-\frac{\dot{y}\ddot{y}}{\dot{t}}-g\dot{t}.\dot{y}-\frac{\dot{x}\ddot{x}}{\dot{t}}=\frac{b}{2}$. fluxion of $(\dot{X}-\dot{x})^2+(\dot{Y}-\dot{y})^2)$ $\therefore$ VII; $\frac{\dot{y}^2}{\dot{t}^2}+\frac{\dot{x}^2}{\dot{t}^2}+2gy+f+b.\frac{\overline{\dot{X}-\dot{x}}|^2+\overline{\dot{Y}-\dot{y}}|^2}{\dot{t}^2}=o$, f being a constant quantity.

Moreover from equations I and II, we have $\frac{\dot{u}-g\dot{t}}{M}=\frac{\dot{v}}{N}$;

therefore from equation IV, we have $\frac{\dot{u}-g\dot{t}}{\dot{v}}=\frac{\dot{X}}{\dot{Y}}$; therefore

by equation V, $\frac{\ddot{y}+g\dot{t}^2}{\ddot{x}}=-\frac{\dot{X}}{\dot{Y}}$. We have now the means of examining whether the simple mechanism of the cheeks and silken thread is sufficient for the requisite of the body not moving about C (that is D of fig. 1.) as a centre, for were that the case, the angle which GC makes with the perpendicular, BC to the cheek would be constant. But the tangent of the angle FCD $=-\frac{\dot{Y}}{\dot{X}}$, and the tangent of the angle GCD

$=\frac{X-x}{Y-y}$, or because $\overline{X-x}|^2+\overline{Y-y}|^2=a^2$, its equal $-\frac{\dot{Y}-\dot{y}}{\dot{X}-\dot{x}}$, and therefore the tangent of the difference of those angles

the angle GCF $=\dfrac{-\frac{\dot{Y}-\dot{y}}{\dot{X}-\dot{x}}+\frac{\dot{Y}}{\dot{X}}}{1+\frac{\dot{Y}-\dot{y}}{\dot{X}-\dot{x}}\cdot\frac{\dot{Y}}{\dot{X}}}=\dfrac{\dot{X}\dot{y}-\dot{Y}\dot{x}}{\dot{X}^2-\dot{X}\dot{x}+\dot{Y}^2-\dot{Y}\dot{y}}=$ a given quantity; and consequently by help of this and the equations above, we are able to determine what curve the cheek ought to be in order for the body not to be moveable about the point C, and we therefore see, that when the cheek is chosen at pleasure, that in fact the simple mechanism of the cheek and thread is really not sufficient for the purpose. I shall, however, not at present further consider the general case of the $<$GCF being any given quantity, but proceed to the case of its being $=o$, that is when BCG is to be constantly a right line, as this seems to be the idea in the attempts to apply the cycloid for the purpose of tautochronism. In this case or last equation will evidently give, $\frac{\dot{X}}{\dot{Y}}=\frac{\dot{x}}{\dot{y}}$, and

therefore our equation $\frac{\ddot{y}+g\dot{t}^2}{\ddot{x}}=-\frac{\dot{X}}{\dot{Y}}$ gives $\dot{y}\ddot{y}+g\dot{t}^2\dot{y}+$

$\dot{x}\ddot{x} = o$, and therefore k being a constant quantity $\dot{y}^2 + \dot{x}^2 + 2gt^2 y + k\dot{t}^2 = o$, and therefore by equation VII, $(f-k)\dot{t}^2 + b\,(\overline{\dot{X}-\dot{x}}|^2 + \overline{\dot{Y}-\dot{y}}|^2) = o$; therefore by means of one of these last equations exterminating $\dot{t}$ from the other, we have $\dot{y}^2 + \dot{x}^2 + \frac{2gy+k}{k-f} \cdot b\,(\overline{\dot{X}-\dot{x}}|^2 + \overline{\dot{Y}-\dot{y}}|^2) = o$, now suppose $\frac{\dot{X}}{\dot{Y}}$ which is to be equal to $\frac{\dot{x}}{\dot{y}}$ to be equal to R, and the last equation will become $\dot{y}^2\,\overline{1+R^2} + \frac{2gy+k}{k-f} \cdot b\,(R^2 \cdot \overline{\dot{Y}-\dot{y}}|^2 + \overline{\dot{Y}-\dot{y}}|^2) = o$ and therefore either $1 + R^2 = o$ which is impossible, or $\dot{y}^2 + \frac{2gy+k}{k-f} \cdot b \cdot \overline{\dot{Y}-\dot{y}}|^2 = o$; $\therefore\ \dot{Y}-\dot{y} = \sqrt{\frac{f-k}{b}} \cdot \frac{\dot{y}}{\sqrt{k+2gy}}$; $\therefore$ $Y = y + \frac{1}{g}\sqrt{\frac{f-k}{b}}\sqrt{k+2gy} + h$; h being a constant quantity; but because $\dot{x} = R\dot{y}$ and $\dot{X} = R\dot{Y}$, consequently $\frac{\dot{X}-\dot{x}}{\dot{Y}-\dot{y}} = R$ hence because as shewn above $\frac{\dot{X}-\dot{x}}{\dot{Y}-\dot{y}}$ is equal to $-\frac{Y-y}{X-x}$ we have R or its equal $\frac{\dot{x}}{\dot{y}} = -\left(\frac{1}{g}\sqrt{\frac{f-k}{b}}\sqrt{k+2gy} + h\right) \div \sqrt{a^2 - \left(\frac{1}{g}\sqrt{\frac{f-k}{b}}\sqrt{k+2gy} + h\right)^2}$ this is plain from the recollection of the equation $\overline{X-x}|^2 + \overline{Y-y}|^2 = a^2$; to proceed put $\frac{k}{2g} = r$, $\sqrt{2 \cdot \frac{f-k}{b} g} = n$ $\therefore\ \dot{x} = \dot{y} \times \frac{-n\sqrt{r+y}-h}{\sqrt{a^2-(n\sqrt{r+y}+h)^2}}$ to find the fluent put $-n\sqrt{r+y}-h = w$; $\therefore n^2 r + n^2 y = \overline{w+h}|^2$; $\therefore\ \dot{y} = \frac{2}{n^2}\dot{w}\,\overline{w+h}$; consequently $\dot{x} = \frac{2}{n^2}\frac{w\dot{w}+h\dot{w}}{\sqrt{a^2-w^2}}$; $\therefore x = -\frac{2}{n^2}\sqrt{a^2-w^2} + \frac{2h}{n^2 a} \times$ (arc whose sine is w and radius a) $+ e$; e being some constant quantity; that is by restoration $x = -\frac{2}{n^2}\sqrt{a^2 - \overline{\frac{1}{g}\sqrt{\frac{f-k}{b}}\sqrt{k+2gy}+h}|^2} + \frac{2h}{n^2 a} \cdot$ arc whose sine

is $\frac{1}{g}\sqrt{\frac{f-k}{b}}\sqrt{k+2gy}+h,$ to the radius $a, +e$; for the equation of the curve described by the centre of gravity of the body, when the thread produced in a right line constantly passes through the said centre of gravity: in the particular case of h equal to o, this gives a parabola; moreover, from the last equation and those above, it is evident, that the equation of the cheek having the proposed property may be found. We perceive in our last equation, four arbitrary constant quantities, these are determinable when we have the origin of the co-ordinates given, and the velocities and directions of C and G given at any proper period.

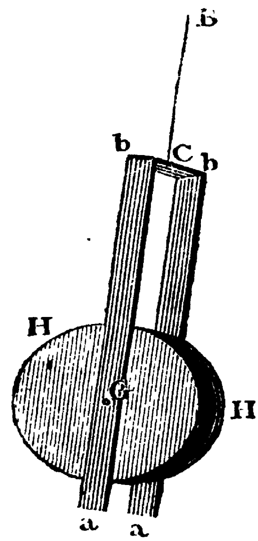
And here I observe, that if C and G are at rest at the same time, which appears to be the idea in the application of the cycloid cheeks, we shall have at that time $2gy+f=o$ and $2gy+k=o$; and therefore the constant quantities f and k equal to each other; but generally $(f-k)\,.\,\dot{t}^2 + \overline{b\,.\,(\dot{X}-\dot{x})^2+(\dot{Y}-\dot{y})^2}=o$ ∴ $\dot{X}=\dot{x}$ and $\dot{Y}=\dot{y}$ generally if C and G are ever at rest at the same time; and taking the fluents $X=x+A$ and $Y=y+B$; A and B being constant quantities: but $\overline{X-x}|^2+\overline{Y-y}|^2=a^2$ ∴ $A^2+B^2=a^2$; but as GC is by hypothesis to be perpendicular to the line described by G or C, it follows that the sine of the angle, that line makes with CD is $=\frac{B}{a}$, and is constant: and that line is therefore a right line, and this may be shown immediately from the equations above. It is to be observed, that the determination of $X=\dot{x}$ and $Y=\dot{y}$ from the equation $(f-k)\dot{t}^2 + b\,(\overline{\dot{X}-\dot{x}}|^2+\overline{\dot{Y}-\dot{y}}|^2)=o$ when $f=k$; arises from the impossibility of its not being so. Hence it appears, that the requisite of the thread continuing to pass through the centre of gravity of the pendulum, is incompatible with the simple mechanism of any cheek and silken thread. I think this fact is not generally known. It likewise appears, that if a body be hung to a fixed point by a thread, one end of which is fastened to the said fixed point, and the other end to some point C of the body, which is not the centre of gravity thereof, such

thread during the vibrations of the body will not continually pass through its centre of gravity.

And from the first of these two last remarks, there is another immediately offered, namely, that in the vibrations of pendulums by means of the silken thread and cheeks, it may happen, and without having gone through the calculation, I venture to say most probably would oftener than not happen, that the thread does not quit one cheek to fold about the other, at the same time that the pendulum, or perhaps more properly speaking the point where the thread is fastened to the body, has performed half its vibration: this I think will produce an unexpected irregularity in the motion of the pendulum. Indeed I am told that there is a clock in the Observatory at Greenwich, whose pendulum was intended to vibrate between cycloid cheeks for the purpose of tautochronism, and that it has since been found that the flexible part of the pendulum (which I should add I am told is a spring) only winds about one of the cheeks.

Before I leave the cycloid cheek I shall offer a construction of a pendulum, which I think would correct in a great part its insufficiency when large, to produce tautochronism; we have already said the received theory is correct when the matter of the pendulum can be considered to be concentrated in one point, which, however, I have shewn cannot be properly so considered in the common constructions; and that it would be very incorrect when the matter of the pendulum is great, the construction is therefore as follows:

Fig. 4.



Let HGH fig. 4. be a heavy body, having an axis passing through its centre of gravity G; *ba*, *ba* two sufficiently strong slender bars fastened together at the top *b.b*, and sufficiently apart below to allow the heavy body HGH to be put in between them, whose axis is to be moveable in centres, in the bars *ba*, *ba*; this being done, let a thread BC have one end C fixed to the top *bb* of the bars, and the other end B fixed between the cycloid cheeks in the usual way; then it is plain, if the weight of the body HGH be great in comparison to the bars and thread by neglecting their effect as inconsiderable, we may consider the weight of the pendulum as all collected in G; provided there be little or no friction between the axis passing through G, and its centre, This point G, it is worth remarking, would be the centre of oscillation as well as the centre of gravity of the pendulum, whether the thread moves about a fixed point B, or winds about a cheek; which is not the case in the common construction. I may add, that in the common construction when the thread winds about a cheek, the place of the centre of oscillation in the weight is continually varying. Lest these remarks should appear to be in contradiction with our last solution, I observe that to bring that data to the case before us, we must take *a* equal to *o*, and then that solution would fail.

If we are not restricted to the caseof $\frac{\dot{X}}{\dot{Y}} = \frac{\dot{x}}{\dot{y}}$ proceed thus,

Equation V. may be written $\frac{\text{fluxion of } \frac{\dot{y}}{\dot{t}} + gt}{\text{fluxion of } \frac{\dot{x}}{\dot{t}}} = -\frac{\dot{X}}{\dot{Y}}$ in

which we may choose the fluxion which is to flow uniformly, as is evident from equations I, II, IV, V; ∴ from equation VII. exterminating $\dot{t}$, we shall have a fluxional equation, between x, y X and Y, then by help of the equation $\overline{X - x}|^2 + \overline{Y - y}|^2 = a^2$, and some other equation, such as the relation between X and Y, if the equation of the cheek should be given, or if it

were required that the body had no motion about C as above hinted instead of having the cheek given, using the equation

$$\frac{X\dot{y}-Y\dot{x}}{X^2-X\dot{x}+Y^2-Y\dot{y}} = \text{a given magnitude,}$$ exterminating two of the unknown quantities, we shall have the equation of the curve described by the centre of gravity of the body, &c.

Moreover the action of the body on the groove is in the direction FC and $= -\dfrac{N}{\text{cos. of CFD}} = -\dfrac{\dot{v}}{\dot{t}\,\text{cos. of CFD}}$; consequently if this be affirmative, and instead of C being acted on by the groove, it be acted on merely by the silken thread BC winding about the cheek at B, the thread would become slack and cease to act.

ART. III. MEDICAL JURISPRUDENCE. *Foderé Médicine légale, 8vo. 6 vols. Paris,* 1813. *Orfila Toxocologie générale considérée, sous les Rapports de la Physiologie, de la Pathologie, et de la Médicine légale, Paris,* 1815.

OUR attention has been directed to the science of Medical Jurisprudence or *State Medicine*, as it is termed in Germany, by some recent publications of considerable merit. As a science it is not known in this country, nor does it form any part of the necessary studies of the medical practitioner. In the present Paper, we shall point out what we consider to be its leading branches; and we are so convinced of the benefit which would result to mankind from a more general attention to this science, that we shall not apologize for having entered on a subject which may probably be considered not to be immediately within the limits of our journal. The science of Medical Jurisprudence comprehends the evidence and opinions necessary to be given in courts of justice, by practitioners, on all subjects relating to their profession: according to the English laws, the testimony or the opinions of medical

men are not directly required, though it is usual in certain cases, to require their evidence on professional subjects: public attention has been of late called to the laws now in force relating to coroner's inquests, and the mode in which they are administered. This subject is intimately connected with Medical Jurisprudence. Without wishing to discuss the propriety of the laws for the punishment of suicide, so far as they relate to the forfeiture of property, and the giving publicity to the offence; there can be little question but that the exposure of the body of the suicide is not consonant to the feelings of the present age; and yet it cannot be forgotten, that within a short period the body of an unfortunate wretch was, in open day, dragged in procession along the public way, headed by the civil power. Very slight evidence, or rather no evidence at all, but merely the discretion of the coroner, is sufficient to procure a verdict of lunacy; and that such verdicts are often corruptly procured, no person who has attended to the proceedings of coroners' inquests, can have any doubt. It may be questioned whether an ignominious burial has any direct tendency to the prevention of suicide; and unless it is clearly established that it has, in an enlightened age like the present so barbarous and disgusting a law should be abolished, or at least why should not the very fact of suicide be considered in *all* cases, as affording evidence of insanity? It is of the utmost importance to the due administration of justice that the evidence before the coroner should be complete and correct. To insure this, it will be requisite that enactments should be made, at once regulating the mode of producing such evidence, and the class of persons by whom it is to be given. Several instances of the grossest neglect and irregularity in the evidence of medical persons have come to our knowledge; the following is one of the most flagrant:—a servant had died in consequence of poison; it was supposed she had taken it purposely, though she stated that it was taken by her as a dose of salts which had been carelessly left about by another servant: there was, however reason to suspect that she had been pregnant, and had lately miscarried. The prejudice was consi-

derably excited in favour of the deceased having taken the poison accidentally. Two medical gentlemen of eminence attended to examine the body; the apothecary who was to give evidence before the coroner, was also in attendance; and as, from the early part of the examination, there was little question but that the woman had been pregnant, on the examination proceeding, the apothecary actually left the room, stating, that as he was to be examined before the coroner, if he gave any evidence which might seem prejudicial to the character of the deceased, it would seriously affect his professional interests in the neighbourhood! Now, in this case, independently of false evidence having been in fact given before the coroner, injustice was done to the servant who was supposed to have brought the poison into the house. In order to insure proper attention and skill on the part of medical persons who may be called in to give their evidence before coroners, we should propose that in addition to the usual course of education, all medical students should be required to attend a certain number of lectures exclusively on the subject of Medical Jurisprudence, in which their attention would be particularly called to those parts of the science of medicine, respecting which they would be liable to be called upon to give their opinions, in courts of justice, with peculiar directions as to the nature of the proof required, and the effect of their testimony. In addition to this, we conceive much benefit would arise from the prescribing particular rules to be adopted in all cases of sudden or suspicious death; and making it imperative on the coroner to employ particular medical persons (who should be remunerated); and for this purpose a certain number of practitioners in each county, who had previously passed such examination as might be thought fit, should be named as the persons to be employed by the coroner; and that every such examination should be made according to certain directions to be determined on, and a report of it in writing signed and sworn to by the person making it. In order to facilitate the mode of making these examinations and reports, certain printed formulæ might be devised, stating the mode of examination to be pursued, and the results; such formulæ, of

course to be varied according to circumstances. This is the mode adopted in France, and in other countries in Europe, and from the adoption of which we conceive much benefit would arise. The reporter might still be examined *vivâ voce*, either before the coroner, or on the trial. Independent of the improvement which would result from this, in the administration of justice, much good would arise from the removal of doubt and suspicion in the public, which is often misled by the evidence given before coroners, on medical subjects, owing to the unfitness of the persons employed There can be little question, that had the examinations and analysis been skilfully made, no public disturbance or discontent would have arisen in the case of Elizabeth Fenning, who was executed for an attempt to poison the family of a stationer, in Chancery-lane.

The evidence of medical men, amongst lawyers, is a subject of general animadversion; and indeed it is impossible to refer to the several printed trials, such as those of Spencer Cowper Donellan, and others, without astonishment at the inconsistency and uncertainty which seems to have pervaded the opinions of former medical practitioners.

It may also be expected, that much good will result from the canvassing the points necessary to be attended to, in examinations of the nature we have mentioned, and that greater skill will be attained, and important discoveries made, in the application of remedies in cases of suspended animation, the administration of poison, &c. respecting which, little attention seems to have been paid by the generality of the present practitioners, at least those of the second class; and it is amongst the second class that skill and knowledge in this branch of science is particularly required, as they are most frequently called upon in cases of poison, &c.

The first directions respecting the consulting medical men, in the administration of justice, in any modern code, is in the Constitutio Criminalis Carolina, of Charles V. which enacts, that the evidence of medical men shall be taken in cases of violent death, poison, child murder, &c.; and now by the laws of most of the States in the Continent of Europe, their evidence is required in similar cases. The code Napoleon,

one of the most singular productions of modern Jurisprudence, gives, at considerable length, the rules to be observed in making the necessary reports, and in the testimony on medical subjects connected with Jurisprudence.

The most distinguished works on this science, amongst the Germans, are, the Pandectæ Medico-legales, of Valentini, 1702; the works of Plenk, Frank, and Sikora, together with the Colatio Opusculorum Selectorum ad Medicinam Forensem spectantium: curante Schlegel, 1787.

Amongst the Italians, Paul Zacchias is most distinguished. Ambrose Paré was the first in France who treated on this subject; and the Médicine légale et Police médicale, of M. Mahon; "the Course of Legal Medicine," of M. Belloc; the Médicine légale of M. Foderé, and the Toxicology of M. Orfila, are amongst the most eminent of the modern French works on the subject. In this country, with the exception of the Lectures of Dr. Duncan, of Edinburgh (where there is a professorship, for the study of Medical Jurisprudence) we have no publication of any note, although there are several Essays, on particular subjects relating to Medical Jurisprudence, of considerable value. Amongst the foremost, is to be reckoned the Paper of Dr. W. Hunter, on the uncertainty of the signs of murder in bastard children.

We shall conclude our remarks on this subject, with a concise enumeration of the subjects embraced by the science of Medical Jurisprudence, which we shall notice in the order in which they are treated of in the work of M. Foderé, which, though very prolix, and written without either great professional skill or talent, contains much curious information on the science, as well as the opinions of most of the preceding writers on the subjects discussed.

The *physical qualities* of man, form one of the first and most important subjects of enquiry. According to the laws of all civilized nations, there are certain fixed epochs when reason is to be considered as sufficiently developed for the exercise of certain acts; such as the dominion over property—union of sexes—holding of offices, &c.—Majority is to be considered a civil institution, varying in different nations

and climates. In the debates on the code Napoleon, no point was more discussed, than, whether the period of majority should be fixed at 21 or 25; but the former was determined on, except in the case of power to contract marriage, and the discharge of some particular functions. Many cases may arise, and have arisen in this country, in which the age of a party is only to be ascertained by presumption, and it is obvious, that the opinion of medical men on this subject, must have considerable weight. A considerable portion of the first volume of M. Foderé's work, is taken up in discussing the physical powers of man, at different ages, as far as regards his legal capacities—the commission of crime, and infliction of injury. The Médicine légale of M. Foderé contains a very detailed commentary on the code Napoleon, which, like many other codes, attempts to establish a scale of the physical powers of man, by which their faculties and incapacities are to be ascertained. Zacchias, one of the most sensible writers who have considered this subject, which, it seems, has (fruitlessly enough, in our opinion,) occupied the attention of many jurists and medical writers, admits, that the legal period of age, must arise from arbitrary presumption, rather than from any rules resulting from observation of nature, whose variations are infinite.

Many important points arise on the question when the period of gestation ceases: from 45 to 50 is the ordinary time, though there are exceptions. This point was much canvassed in the Douglas cause. Haller, speaking upon this subject, mentions many women who have borne long after 50, and who, it may be said, experienced a sort of second youth—have borne, as he states, up to 70. The English law admits of no presumption, as to the time when a woman ceases to have children, though this enters into most other codes. In England, property, which reverts to the parents, in default of issue, is frequently tied up till after their death, though the moral probability of their having issue may long have ceased.—Many curious points seem to have arisen in France and other countries, with respect to identity; and the subject, in all the treatises, is noticed at considerable length.

The next point is, the relative and absolute duration of life. In case of absence, the English law admits of great latitude; and as each particular instance is determined by a jury there is very little certainty as yet established; great practical convenience, however, would result from fixed rules on this subject.—The relative mortality of the sexes is also considered, at length, by M. Foderé.

The presumption of survivorship, amongst persons perishing by the same mischance, as shipwreck, suffocation, &c. When no positive evidence can be procured, as to the exact periods of their death, is also another point of which the foreign jurists have written much, but respecting which, we have no positive rules in this country. It frequently becomes a question of considerable importance, in the devolution of property, to ascertain which of two persons survived; as parent or child, testator or legatee, &c. The laws of several nations, have admitted of arguments, drawn from the relative supposed physical powers of the parties to sustain life, such as are to be inferred from the difference of age, sex, &c.

In imitation of the civil law-codes, the code Napoleon has attempted to lay down particular rules for the devolution of property, in cases of this nature; we extract the following passages:—"persons dying, who are the legal representatives to each other, without it being known which died first, the presumption of survivorship is to be determined by the circumstances of the case, and in default thereof, by the strength, age, and sex of the parties. If those who shall so die together, shall be both under 16, then the *eldest* shall be presumed to have survived; if they were all above 60, then the *youngest* shall be presumed to have survived; if some under 15, and others above 60, then the first shall be presumed to have survived; if all are above 15, and under 60, then the male is presumed to have survived, if the ages are equal, or the difference does not exceed a year; if they were of the same sex, then the presumption of survivorship, according to the order of nature, is to be adopted, and the younger is supposed to have survived the elder." In this there is an odd mixture of arbitrary rules, and an attempt at reaching the

probable truth, by a comparative estimate of the physical powers of man; besides, many objections might be made to the above rules, as far as they attempt to regulate *on principle*, the doctrine of presumptions, we conceive, that the simplest law, and the one that would most probably come nearest to natural justice, would be to enact, that in all cases, the order of nature should be presumed to have taken place, and therefore, if father and child died, whatever their probable physical powers, the child should, as in the course of nature, be considered as having survived the father; and so in all cases of succession. The English law, on this subject, is entirely defective, and although there have been questions in which it was necessary to decide which was the survivor, in the absence of all but presumptive evidence, it does not appear that any decision was ever made, or that any principle of law was admitted, either original, or as adopted from the civil code; whereas, if some fixed rule were adopted, parties at least would not be ignorant of the nature of their rights. In a cause lately before the Court of Chancery, which was the case of a legatee and testator being shipwrecked in the same ship, it was sent by the Master of the Rolls, to be tried by a jury *which survived*, though he admitted there was a *total absence of all evidence*, on which they could found their verdict; whereas, had some principle, with regard to legatees and testator dying, been adopted, no question could have arisen. Notwithstanding the manifest fallacy of all reasoning tending to prove who was the survivor from the relative physical faculties of the deceased, it seems to have been a frequent subject of speculation amongst the writers on Medical Jurisprudence; and a very considerable part of the second volume of Foderé's work, is devoted to the consideration of the modes of ascertaining the probable survivor, in cases of death, by shipwreck, fire, cold, suffocation, &c.

The consideration and study of the different defects of the mind, form an important branch of the study of Medical Jurisprudence. Pinel has divided the diseases of the mind into four classes;—*mania*, or general delirium; *melancholia*, or exclusive delirium; *dementia*, or obliteration of

thought, and *idiotism*, or abolition of the intellectual faculties. But the diseases of the mind are so varied, that it is difficult, with certainty, to class symptoms admitting of such infinite variety; however, questions at once involving life and property, are frequently dependent on the judgment and the evidence of the practitioner. From insanity are to be distinguished hysterical affections, the effects of depraved instincts, jealousy and inebriety, excesses arising from sudden accessions of peculiar passions of the mind, and temporary alienations of reason arising from disease. In considering the faculties of man, many curious questions arise on the moral and physical powers of those who are born deaf and dumb, as to their capacity of performing the different functions of life, and how far they are amenable to punishment for the commission of crimes. In this country, these are questions on which a jury alone decide. Another question, in which the testimony of medical men is of considerable importance, is the consideration how far persons affected by disease, executing a will, are to be considered in a situation to judge of the propriety of the act executed by them.

Of Marriage.—Few, if any, questions are now likely to arise in England, relating to the *time* and *capacity* of parties to marry. The subject of marriage involves that of *impotence*, which may be divided into absolute and perpetual, relative and accidental, or temporary, curable and incurable.

Pregnancy.—No one part of legal medicine involves so many important questions, as *conception* and *childbirth*; and none are more entangled with difficulties. These points, from their importance, call for the greatest care and circumspection. The signs of conception are divided into rational, particular, and sensible; and notwithstanding the advancement of science, the knowledge both of the one, and the other of these signs, is sometimes involved in great difficulty, and frequent errors occur, in the judgment of the most experienced practitioners, even when women have no motive for concealment. The question of superfœtation, has given rise to much learned discussion: M. Foderé sides with Buffon, Haller, and the other advocates for it—and thinks it is of

rare occurrence, but not impossible. A case of a woman who had twins, one white and the other black, is mentioned by Buffon.

The symptoms of delivery, and how far they are to be distinguished from all other uterine excretions, form another important topic; as also the period of time after delivery, the symptoms may be ascertained with certainty.—The capacity of women in labour to render proper assistance to the fœtus, so as to preserve life.—The determining whether the fœtus died before, or after delivery—upon this point much difference of opinion exists, and it is deserving of considerable attention, in order to enable the practitioner to do justice in giving his opinion.

Utero-gestation.—The next object of discussion, is the period of utero-gestation. In all other animals, the period of utero-gestation is very constant. Haller states, that the time of going with young is very regular in animals, but that it is not so regular in women. He gives references by which we read of a woman going ten, eleven, twelve, thirteen, and even fourteen months. Hippocrates says, that, "he can allow the possibility of a child being born at ten months, but not later." The former system of France allowed ten months. By the code Napoleon, the legitimacy of a child born 300 days after the dissolution of the marriage, may be questioned.

Dr. Clarke, in his Lectures, published under the title of London Practice of Midwifery, treats the possibility of the periods extending beyond the forty weeks with ridicule, though contrary to the opinion of many very distinguished practitioners, and indeed, as some have conceived, contrary to reason; for as the fœtus receives its nourishment from the mother, the probability is, that any very material alteration in her constitution, may cause the retardation, of the maturity of the infant. Besides, the fact of irregularity, in the time of utero-gestation, has been satisfactorily established, in the case of animals, when no motive for prejudice or concealment can arise. With regard to the legitimacy of children born in wedlock, only two reasons are allowed against

the legitimacy of the child by the code Napoleon; viz. absence of the husband, or his being affected by some disease, by which it is to be inferred, it is impossible he should be the father of the child. Non access is the only ground of disputing the legitimacy in England; but the rule of evidence in this respect, has been of late very materially altered, by the opinions of the judges in the Banbury peerage, who have, it is conceived, introduced an *anomalous* division respecting the evidence of access, dividing it into *access*, and *generative access*; so that if this distinction be hereafter recognised, much uncertainty may be introduced respecting the title and succession to property, and a new and difficult subject will demand the attention of the medical student.

In discussing the time when the fœtus may be supposed to be perfect, the faculty of Leipsic, with great complaisance, determined that a child, born five months and eight days after the return of the husband, might be considered as legitimate, and that children at five months, were often perfect and healthy. *Valentini*, who reports this decision, is also gallant enough to concur in it.

By the English laws, an husband is entitled to a life interest in the estate of his wife, if he have a child born alive; and the expression of the old law is, if the child should be heard to cry. Some cases, where children have been born alive, but have not uttered any cry, though they have breathed for a continued period, have caused much learned discussion; and a case in 1806, in the Exchequer, (where the lips of an infant had moved after birth, but no cry was heard,) gave rise to much curious evidence, particularly by Dr. Denman, who was of opinion, that the motion of the lips immediately after birth, was not a decisive proof of the presence of the vital principle, and distinguished between *uterine* and *exterior* life, the latter being called into action by the operation of the air on the lungs. Each case of this nature in England, is determined by a jury, on its particular circumstances: according to the civil code, *idem est non nasci, et non posse vivere.*

Till the relaxation of the severity of the laws in this

country relating to infanticide, many unfortunate mothers suffered death for crimes they never committed. Prejudice on the-part of the juries, and ignorance on that of the practitioners, seem to have conspired to destroy the wretched mother. Dr. William Hunter, in his able paper on Infanticide, was one of the first who had the credit of turning the public attention to this subject. No one has written more eloquently in favour of the female character; and from the opportunities of observation, which his extensive practice afforded him, there is no one whose opinion is entitled to higher respect. Even now, however, it may be doubted, whether there are not some who suffer unjustly, when the incapacity of the mother to assist her infant in a concealed delivery, the probable accidents arising from position, fainting, and delirium, are considered: the horror excited by the idea of a mother's murdering her offspring, may still prevent mankind from judging of the case of the infanticide with impartiality; added to this, the natural appearances have not unfrequently been attributed to violence; and a case has been noticed as having occurred a few years ago, where the sutures and fontenelle were mistaken by an ignorant practitioner, for fractures of the skull. That to form an opinion, which is to decide the fate of a fellow being, on a subject so difficult, and presenting so extensive a field for observation, requires the narrowest scrutiny and attention, need not be noticed; and the probable improvements in our skill respecting these matters, may be easily imagined, when it is considered, how short time since, the lungs, swimming in water, was considered as decisive evidence, that the fœtus had inspired air, and which is now admitted to afford, at best, but a very uncertain criterion of the existence of extra-uterine vitality.

The cases of monstrous-births have seldom given rise to legal discussion in this country, though the works of foreign writers abound with descriptions of them.

The next class of cases which occur, are, the appearances of death in bodies, and whether the death was natural or violent, as in the case of strangulation, suffocation, drowning, &c. from blows and wounds, &c. and the determining

whether particular wounds are to be considered as mortal; after these, come rape, and feigned diseases, the most frequent of which are, epilepsy, insanity, ulcers, and blindness, &c.

Poisons.—We now come to that part which relates to poisons, which have been treated of by M. Orfila, in the work before noticed, and which is one of the most material and extensive subjects of Medical Jurisprudence. The first part of this work contains the particular history of the different poisonous substances considered under their relations with chemistry, physiology, pathology, and Medical Jurisprudence. The history of each poison, is comprised in different paragraphs: comprehending the explanation of its chemical properties, and external characters; its physiological action, determining the effects of poisonous substances, when administered in doses capable of producing accident, with the results of experiments; the general symptoms; the lesion of texture produced, comprehending the nature of the alterations produced by the poison, the application of the facts in the preceding parts to Medical Jurisprudence; with the different courses to be pursued by the practitioner in cases of poison; lastly, the treatment of poisoning, and the consideration as to whether any thing exists in each case possessing the properties of an antidote.

The second part comprehends all that relates to poisoning generally considered, with the symptoms which distinguish acute poisoning, from diseases, such as cholera morbus, &c. explaining the variations of symptoms, the mode of ascertaining the nature of the poison, the history of slow poisons, with the diagnosis, the examinations of dead bodies of persons poisoned, and the researches proper for establishing a distinction between sudden deaths produced by a natural cause, and those which are the result of the agency of poisons, and a comparison of the lesions of texture exhibited by the dead bodies, under these two circumstances, which are altogether different; and the work concludes with directions for the preparation of tests noticed in the preceding parts. To compose a work containing such extensive and important subjects, it was necessary to institute a numerous series of experiments and

researches, many extremely difficult; and we think this has been done with considerable success by the author. The physical characters and chemical properties of each poison, with the appearance it presents when exposed to the action of the different tests; and the difference which the poison, when mixed with different alimentary substances, presents with the same tests, are distinctly shewn; together with the modification produced by the admixture of the saliva, gastric juice, &c.

M. Orfila treats of the different poisons according to the classification of M. Foderé, as the most rational and conformable to the ideas of physiology.

Class 1. Corrosive Poisons.—So called because they irritate and corrode the texture of the parts with which they come in contact. Their action is in general more formidable than other poisons. All the acids, alkalies, and most of the metallic preparations come under this class. There are 15 species, noticed by M. Orfila, viz. preparations of mercury, arsenic, antimony, copper, tin, zinc, silver, gold, bismuth, the concentrated acids, caustic alkalies, the caustic alkaline earths, muriate andc arbonate of barytes, glass, and enamel in powder and cantharides.

Whenever the smallest quantity of any of these bodies is administered internally, various changes occur either momentary or durable; exciting the brain or heart; or acting as sedatives; increasing or diminishing the customary secretions. Given in larger doses, the poison is absorbed, carrying in some instances its fatal action to the brain and other organs. In certain cases it corrodes the membranes of the stomach, which acts by sympathy on other organs, without absorption taking place. The general symptoms produced by these corrosive substances depend upon the lesions of the alimentary and nervous system, and of the organs of circulation. The corrosive poisons frequently leave behind traces of their passage over our organs. Inflammation of the first passages, contractions of the intestinal canal, gangrene, sphacelus, and perforation of the parts constitute the first character of these lesions, and the mucous coat easily detaches itself from the muscular, and the action is frequently extended to the other viscera, although these cha-

racters are sometimes wanting, and the dead body exhibits no alterations. Various modes have been adopted at different times to counteract the effect of poison, and many serious errors have arisen from practitioners mistaking the results of chemical operations: and the substances administered for the purpose of decomposing the poisons, have exerted no action whatever upon them in the stomach; and even when the decomposition has been effected, the new compound has been endued with active poisonous qualities. "The evacuant, antiphlogistic, and antispasmodic method, appears to us," observes M. Orfila, "to merit the preference, for, without exposing the patient to the danger which a chemical decomposition might subject him, it offers the double advantage of getting rid of the poison by simple means, and re-establishing the faculties at the same time."

In this class of poisons, cases arising from the ingestion of corrosive sublimate, verdigris, arsenious acid, nitric, and sulphuric acid, are most frequent. In France, where the sale of poison is restrained by law,* the most common poisons taken for the purpose of committing suicide, are, the nitric acid of commerce, and a mixture of concentrated sulphuric acid and indigo, used in dyeing. Of all the mineral poisons, the effects of the nitric acid seems most terrific; it acts with great rapidity on the animal economy, producing symptoms almost constantly succeeded by death. In cases of poisoning by these two acids, in addition to mucilaginous drinks and vomits as remedies, Mr. Orfila suggests the administering magnesia suspended in mucilage. Frequent mischief has lately occurred in this country, from the accidental-ingestion of the oxalic acid. This is sold indiscriminately by druggists, under the name of *acid of sugar*, for various domestic purposes, many of whom were, till lately, ignorant of

* The frequent occurrences noticed in the papers, of fatal mistakes, from neglect and ignorance of the apprentices of the retailers of drugs, point out the necessity of some legislative directions, as to the sale of dangerous substances, accompanied by severe penalties, in cases of neglect or ignorance.

its deleterious effect. Nine cases of accidental death are noticed by the editors of the Medical Repository, as having occurred within two years and a half; and the Number for the last December, contains a Report of the case of a death by oxalic acid; a woman having taken nearly an ounce by mistake for Epsom salts. In a short time after taking it, she complained of pain, vomited up a small quantity of fluid, threw herself on the bed, and expired within a quarter of an hour after swallowing the acid. The body, on dissection three days after death, presented appearances similar to those in other cases by death from concentrated acids: the cuticular coat of the œsophagus peeled off with the slightest touch; the blood vessels of the inner coat of the stomach, appeared as if injected with a carbonaceous substance, and the stomach itself was in some parts so completely perforated, that its contents had escaped into the cavity of the abdomen. The conclusion drawn by Mr. A. T. Thomson, from experiments instituted by him, on the nature of this acid, was, that a mixture of chalk and water, by producing oxalate of lime in the stomach, may be regarded as an antidote, if exhibited very soon after the poison has been taken.

In cases of poisoning by corrosive sublimate, in addition to the general remedies for this class, the administration of albumen is recommended by M. Orfila.

The daily use of utensils of copper, and the facility with which copper combines with oxygen, renders accidental poisoning by preparations of it very common. The seat of the lesions of texture, produced by verdigris, is principally in the digestive canal, and when death takes place a few hours after taking the poison, the mucous lining of the stomach is found to be inflamed, and gangrenous: sometimes the inflammation is communicated to all the coats of these viscera, and sloughs are formed, which are quickly detached, and leave openings through which their contents pass out, and are effused into the cavity of the abdomen. Amongst mineral poisons, there are few which exert so powerful an action as the muriate of barytes, as appears from Mr. Brodie's experiments: no case, however, is detailed, of poisoning on the

human frame by the compounds of barytes. Much difference of opinion exists, whether the sharp fragments of glass, &c. which by some are classed as poisons, may be swallowed with impunity. In cases of poison by cantharides, the lesions of texture of the digestive canal are similar to those of other corrosive poisons, occasionally, however, accompanied by inflammation of the bladder. To the corrosive poisons may be added, Iodine, which, from the experiments of M. Orfila, appears, when introduced into the stomach to the amount of a drachm, in dogs, to produce death. Six grains were taken by M. Orfila, which produced violent evacuations, and a pulse of 125: he recovered the effects by the next day.

Class 2. Astringent Poisons,—are so called, because they frequently produce a remarkable constriction of the great intestines, and especially of the colon, and in the end, produce inflammation of the texture of the digestive canal, and frequently exert their action on the nervous system. No medical subject has excited more interest, or given rise to a greater number of monographs, by eminent writers, than the treatment of diseases resulting from the astringent or lead poisons, and for this reason, the mode of cure is best understood, and oftenest followed by success.

The varieties of this poison are, acetate of lead, red oxyde, or litharge, carbonate of lead or cerussa, wine sweetened, and water impregnated by lead. All artificers, who use, or are exposed to the action of lead, or its compounds, are often attacked with the most severe cholics, sometimes succeeded by death, from having only handled saturnine preparations, or even from having been placed within the sphere of their emanations. In these cases, the digestive canal exhibits no vestige of inflammation: a contraction of the diameter of the great intestines, particularly of the colon, accompanied by severe gripings, is the chief symptom, but no fever takes place, whatever the intensity of the pain. Acetate of lead introduced into the stomach, in small quantities, produces inflammation of different parts of it; and the salts of lead, when injected into the veins, destroy life.

As the sulphates of soda, magnesia, &c. decompose the

salts of lead with facility, and a large quantity may be given with impunity, and the metallic sulphate resulting from this decomposition, is insoluble: the sulphate of soda, &c. are therefore recommended by M. Orfila, as the best antidote to the corrosive effects arising from saturnine poisons. The mode of treating the cholic arising trom saturnine emanations, is, of course, altogether different.*

Class 3. The name of *acrid* poisons is given to those with a caustic taste, and which applied to the surface, produce inflammation, usually terminated by suppuration; and which, introduced into the stomach, produce local phenomena, analogous to the corrosive poisons, though some authors have attempted to establish distinctions in the appearance of the lesions of texture on dissection. The action of vegetable and animal poisons on the human frame, being more complex, are more difficult to understand than those of the mineral poisons. The class of acrid poisons is divided into two sections, with reference to their action on the animal economy: the first, highly irritating the membranes, and producing violent inflammation, and a sympathetic action on the brain, which is the principal cause of death; and it does not appear that they become absorbed into the system, or at least, they are so with difficulty. Amongst the chief of these are, the briony root, momordica elaterium, many species of euphorbium,† nitrate of

* For some valuable observations on this subject, see Dr. Pemberton's Treatise on the Diseases of the Abdomical Viscera.

† A case of death by euphorbium, used by farriers for blisters, has been kindly communicated to us by Mr. Furnival, of Egham. A tea-spoonful was administered by a farrier, in the dark, by mistake for rhubarb. Mr. F. saw the patient about six hours after the ingestion of the poison. He described the sensation on swallowing the poison, to be that of burning heat in the throat and fauces, afterwards communicated to the stomach; incessant vomiting of watery fluid took place almost immediately; the tongue was covered with thick mucus; the pulse very irregular, and at least 150; the patient was in a cold perspiration, and unable to speak intelligibly. An emetic of sulphate of zinc and ipecacuanha was given, and its effects quickened by introducing the probang into the œsophagus, a small quantity of thin black fluid only was

potass, and chlorine: the activity of these poisons, is generally greater when introduced into the stomach, than when applied to wounds. Our limits do not admit of entering into details as to the particular action of each: we shall, however, give the conclusions of M. Orfila, from his experiments with the nitrate of potass. 1. It causes death when vomiting has not taken place, and when taken in doses of two or three drachms. 2. It appears to act immediately on the mucous membrane of the digestive canal, and consequently on the nervous system in the same way as stupifying substances do. 3. It is not absorbed when applied to the cellular membrane, and consequently its effects are, in such cases, only local.—The second section of this class comprehends poisons, which, by being absorbed, are taken up by the circulation, and act directly on the brain, at one time stupifying, and at others stimulating to an excess, producing more or less inflammation. Amongst these are the black and white hellebore, aconite, squills, toxicodendron, &c. of which the hellebore offers the most curious effects, causing violent vomitings in a few minutes after its application to a wound, and stupor almost immediately takes place, and death supervenes quicker, even than if the poison had been introduced into the stomach. The white is more active than the black hellebore, and its deleterious parts are those which are soluble in water, consequently more dangerous.

The general mode of treatment in cases of poison by this class, appears to be the antiphlogistic system, rejecting in all cases, acids which have sometimes been proposed, as they constantly increase the irritation.

Class 4. The Narcotic Poisons,—including opium, hyoscyamus, prussic acid, and the vegetable substances containing it. Opium,

discharged; both mucilages and anodynes were given, but almost instantly rejected: he lived nearly three days, and on opening the body, eight hours after death, there were found in the stomach, several spots of mortification, the coats of the stomach ruptured on the slightest touch, the spleen very much enlarged, and tore on the smallest force being applied to it; the vessels of the internal coat of the aorta were most beautifully injected with blood, and shewed marks of the highest degree of inflammation and vascularity.

according to our author, cannot be considered either as coming directly within the class of narcotics, or stimulating poisons, its action being *sui generis.* Animals on having it administered, become first stupified, then exhibit symptoms of considerable excitement, during which they suffer great pain, and violent convulsions supervene, differing considerably from the effects arising from hellebore. The observations on the prussic acid, are interesting. We give shortly the results of M. Orfila's mode of treating this class of poisons. 1. Vegetable acids constantly accelerate death when mixed in the stomach with the poison, as they facilitate the solution of the poison, and consequently its absorption. 2. Acidulated water is useful, when the poison has been rejected. 3 Strong infusion of coffee successfully resisted the effects of narcotic poisons, when administered unremittingly. 4. The decoction of coffee, always less energetic than the infusion. 5. Camphire cannot be considered as an antidote, though beneficial when administered in small doses. 6. Mucilaginous drinks promote the absorption. 7. Bleeding sometimes beneficial.

Class 5. *Narcotic-acrid poisons.*—This class comprehends the upas, nux vomica, some fungi, alcohol, æther, belladonna, stramonium, tobacco, hemlock, &c. The results of M. Orfila's experiments correspond with those of former writers on those poisons, amongst the most distinguished of whom is Mr. Brodie.

The last class is composed of the *septic poisons,* which produce general weakness, and syncope, without in general altering the intellectual faculties. In this class is sulphuretted hydrogene gas, and the venemous animals whose bite or sting is accompanied by pain or death. Our limits preclude us from noticing the mode of treatment of cases arising from poisoning by these two classes.

The detailed account of the poisons is followed by general observations of the utmost consequence to the science of Medical Jurisprudence: they chiefly consist in the description of spontaneous diseases, which are frequently confounded with cases of poison, as cholera morbus, indigestion, malig-

nant fever &c. and the affinities of the appearances of these are carefully examined and distinguished from the operations of poison.

That the subject of medical Jurisprudence is of the most serious importance, we think it is unnecessary to repeat. We have merely, in an hasty sketch, glanced at the points most likely to occur in the practice of medical men; and although of late, some attention seems to have been paid to the subject, still it is obvious that much remains to be done.

ART. IV. *A Descriptive Account of Mr. Thompson's Laboratory at Cheltenham, for the Preparation of the Cheltenham Salts; with a Chemical Analysis of the Waters whence they are produced. By* W. T. BRANDE, *Esq. Sec. R. S. F. R. S. E. M. Geol. Soc. Prof. Chem. R. I. &c.; and* SAMUEL PARKES, *Esq. M. R. I. F. L. S. M. Geol. Soc. &c.*

THE town of Cheltenham, in the County of Gloucester, is situated 95 miles north-west of London, on the borders of a fertile vale, and nearly surrounded by hills of magnesian limestone. A stiff blue clay, containing abundance of iron pyrites, with a great variety of marine animal remains, for the most part covers the limestone; and this bed of clay, intersected occasionally by veins of sand, runs out from the hills to a considerable distance under the soil of the valley. Thus situated, the vale has the appearance of a large amphitheatre; and considering the materials of which the several strata are formed, together with those of the surrounding hills, a geologist would expect to find abundance of *mineral waters* throughout the district. Therefore, notwithstanding their variety, their production may be satisfactorily accounted for on natural principles. For, although carbonate of soda, sulphate of soda, and muriate of soda, together with carbonate of iron,

muriate of magnesia, and sulphate of magnesia, may all be procured from these waters, there is no difficulty in accounting for the origin of each of these salts. The decomposition of the martial pyrites would furnish the carbonate of iron, which renders these waters so highly chalybeate; likewise the acid for the production of all the sulphuric salts, as well as the sulphur for the formation of the sulphuretted hydrogen found in these waters. The muriate of soda or common salt is doubtless coeval with the abundance of marine animal remains which are disseminated throughout the mass of aluminous earth, and came originally from the ocean—the sulphuric acid from the iron pyrites coming in contact with the magnesian limestone, will fully account for the presence of magnesia, and for the saline matter usually designated by the name of Epsom salt; and as it is well known, that at a low temperature sulphate of magnesia will decompose muriate of soda, this will fully account for the origin of the alkali, which is the base of the sulphate of soda, or Glauber's salt, which always occurs in a state of solution in these waters.

From the best information which we have been able to obtain, we have learned that it is nearly one hundred years since the waters of Cheltenham were recommended for their medicinal qualities, and that the first well was railed in about the year 1718.

For many years subsequent to this period, the properties of these waters were treated of by various medical writers; and between the years 1770 and 1780 they acquired so much reputation, that the town became a place of great resort for invalids, from all parts of the kingdom.

But as the celebrity of the waters increased, it was soon found that the wells could not supply the quantity which was required by the increased demand; and in the year 1788 a new well was sunk by order of his present Majesty, known by the name of the *King's well.* At first the supply from this well was very abundant, but it afterwards decreased so much, that it was often drank out by the company in half an hour.

The waters of all the wells having thus continued to diminish in quantity, serious apprehensions were entertained that the company which had been in the habit of visiting Cheltenham would meet with such frequent disappointments, from the failure of the springs, that they would be induced to look out for some other watering-place, and that in a short time the town would be entirely deserted by the strangers who had formerly visited it, either for the purposes of health or pleasure.

At this period a gentleman of the name of Thompson, who had purchased a great part of the land in the vicinity of Cheltenham, determined to search for mineral water upon his own estate, and to try to supply the deficiency so much complained of. The success he met with soon led him to think of turning this discovery to his own advantage, as well as that of the public; and accordingly a new pump-room was erected, and no exertions were spared, until water was obtained sufficient for the supply of whatever company might resort to the town and neighbourhood

Mr. Thompson, foreseeing the advantages which might be derived from this inexhaustible source, now built a laboratory, for the purpose of concentrating the waters, and extracting the salts from them in a crystalline form. He soon found, however, that a large quantity of water would be necessary, for affording a constant supply to the boilers; and accordingly was obliged to sink many fresh wells before this object could be fully attained. For, owing to the tenacity of the clay, the water will not find its way through it, for any considerable distance, so as to percolate from one well to the other. In consequence of this, the proprietor was under the necessity of sinking upwards of seventy wells, and laying down several thousand feet of pipes, before he could obtain that full supply of water which the laboratory required.

Conceiving that it was desirable to give some account of the situation of the wells—of the different strata cut through—and of the variation in the water, at different depths from the surface—we have obtained from the proprietor an account of the results in sinking the well which is situated nearest to

the laboratory, and this we copy, with the design of furnishing an idea of the nature of these wells in general.

After passing through the soil, they came to a bed of sand, which continued for twelve feet, at which depth fresh water was found; under this was a bed of blue clay, in which, at the depth of fifteen feet, or twenty-seven feet from the surface of the sand, a saline chalybeate water first made its appearance. This the workmen conducted into a distinct reservoir, cut on the side of the well, on purpose for its reception; and they arched it in such a manner, that a pump might be fixed in it so as to draw this water to the surface, without allowing it to mix with any other spring which might be discovered at a still greater depth. Having taken these precautions, the men then proceeded to sink lower; and when they had cut through four feet more of the clay, they came to another spring, of the same nature as the former, but much stronger in its saline properties A separate reservoir having been prepared in the side of the well for this water also, as in the former case, the men proceeded to sink to the depth of forty-four feet more, in the same bed of clay, before another spring made its appearance. This water, which had then a pump fixed in it, was found to be more highly chalybeate than either of the former, and also to contain a much larger portion of common salt.—See Plate I.

Before we describe the process for preparing the Cheltenham salts from the waters of the saline chalybeate, as conducted at Mr. Thompson's manufactory, it will be necessary to give some account of the methods by which the products of the several springs are collected and brought to the laboratory.

Several wells having been sunk to the proper depth, at one hundred feet apart from each other, horizontal borings are then made from one to the other, and half inch leaden pipes are laid in the augur holes, until they become all connected with one main well. In this a pump is fixed, and the working cylinder is placed at a sufficient depth, to draw the water from all the collateral wells. Thus one pump is made to empty nine or ten wells.

Over each of these pumps a building is erected, to secure it from injury; and reservoirs, capable of containing one thousand gallons each, are placed among the wells, in the most convenient situations, for receiving the water. Into these reservoirs all the water from this vast collection of wells is driven by the several forcing pumps; and as these reservoirs are placed at a sufficient elevation, they empty themselves by small uninterrupted streams into a main pipe, which is conducted under ground through the fields down to the laboratory. When it arrives there, the pipe is bent upwards, until it comes high enough to empty itself into a leaden cistern, of about twelve feet square, and which is placed in a convenient situation, for supplying the boilers, without any further labour of bucketing or pumping, but merely by opening a stop-cock, as occasion may require.

The boilers which are employed for concentrating the waters, are very properly* made of wrought iron plates, securely put together with iron rivets. The first boiler is nine feet long, six feet in diameter, and four and a half feet deep. The second is six feet square, and four and a half feet in depth. The third is eight feet by three feet six inches, and two feet eight inches deep. These boilers are covered by plates of iron, united in the same manner; and each cover has an opening of about two and a half feet square, called a man-hole, for the purpose of cleaning out the precipitates from the boilers occasionally. Each man-hole is covered by an iron door, which moves upon strong massive hinges, and this door is screwed down, so as to make the boiler impervious to the steam which is constantly generated within. In the cover of the largest boiler an iron pipe, five inches diameter, is fixed, for the purpose of carrying off the steam; and this is conveyed underneath the laboratory to an adjoining building, for the purpose of heating the public baths. Smaller pipes are also fixed in the cover of this and the other boilers, for the collec-

* We say these are very *properly* made of iron, because we know, that in some establishments utensils of copper are employed for the preparation of medicinal salts.

tion of a sufficient quantity of steam, to be employed in warming the counting-houses, the dressing-rooms at the baths, and all the other rooms belonging to the establishment. The three boilers, which are placed end to end in one continued row, are heated by one fire, which is placed at one end of the largest boiler, and from this the heat is communicated to the other two in succession. When these boilers are charged with the mineral water, the fire is lighted beneath them, and as soon as the evaporation has properly commenced, the cocks are partially opened which connect with the large leaden cisterns, so as to allow a small stream of the mineral water perpetually to run into the boilers, and repair the waste of fluid which the evaporation constantly occasions.

When the evaporation from the large boiler has been thus continued for seven days and nights uninterruptedly, amounting to not less than ninety-six gallons every hour, a large cock in the room beneath is opened, and the whole contents of the evaporating vessel is let off into a capacious cooler, in which a strainer is placed, for the purpose of arresting the carbonate of lime, magnesia, and the other insoluble matter which had been precipitated from the fluid, by the operation of boiling. The magnesian precipitate, which is generally very abundant, is unfit for medicinal use, in consequence of the carbonate of lime which falls with it. The proprietor, therefore, treats it with sulphuric acid, which has the property of forming a soluble salt with the magnesian earth, and an almost insoluble one with the calcareous, by which means the lime and the magnesia are separated. The magnesia having thus been again brought into a state of solution, the operator draws it off by a syphon from the precipitated sulphate of lime, and carries it to the evaporating pan, where it is concentrated and prepared for crystallization. The liquor in the second boiler, when it is thought to be sufficiently concentrated, is run off and filtered in the same manner.

When the earthy salt has had time to subside, and the filtration is completed, which generally requires twelve hours

to accomplish, the filtrated liquor is pumped up into the small boiler, No. 3, for the purpose of being farther concentrated. In this vessel the evaporation is generally continued for a week, without allowing the liquor ever to boil in it. At the end of this period a pellicle usually appears upon the surface of the saline fluid, and this is considered by the operator as a sufficient indication that the lixivium has attained that point of concentration at which it ought to be withdrawn from the boiler, and set aside for the salts to crystallize.

For this purpose a cock fixed in the bottom of the boiler is opened, and the whole contents let down into a large receptacle of wood placed underneath it; when the boiler is again filled as before, for a repetition of the operation.

When this concentrated lixivium is removed from the boiler, it is allowed to remain undisturbed in the wooden cistern for twenty-four hours, that any magnesian or calcareous earth may subside, which had not been separated by the previous filtration. The liquor, perfectly transparent, and at about the temperature of 90°, is then drawn off and conveyed to the crystallizing vessel, which is a deep iron pan, five feet diameter, and lined at the bottom, and in its whole circumference, with marble, to prevent the salts from acquiring any stain. When this vessel is filled, a number of loose sticks are laid to float upon the surface of the liquor, for the salts to attach themselves to, that the crystallization may be distinct and not in a confused mass, as it would otherwise be at the bottom of the cooler.

When the crystallization, which requires from two to five days, according to the season of the year and the state of the weather, is thought to be complete, the mother liquor is drawn off, and poured into a number of wooden vessels, where it remains a few days, for the purpose of procuring a second crop of crystals. The whole of the mother liquor being thus removed from the large crystallizing vessel, the salts are then taken out with appropriate shovels, and put into baskets to drain, preparatory to their being carried to the stove to be dried for sale. This first produce of the Cheltenham waters

is known by the name of the "Cheltenham Alkaline Salts."*

When the second crop of crystals has been obtained, the mother liquor is removed to another part of the laboratory, and poured into several iron pans set within the ground, so as for the upper edge of each to be level with the floor of the building. Here, by a long protracted evaporation, the mothers become still more concentrated, and then the muriate of soda begins to shew itself in a pellicle at the surface of the liquor, and this continues to collect, repeatedly falling as it forms, until the whole of the muriatic salt is separated. As there is something curious in the construction of this apparatus, it may be worth while to describe it, before we proceed to examine the remaining processes of the laboratory.

When the proprietor found how large a quantity of steam would be produced by the salt-pans, it occurred to him, that instead of letting it escape into the atmosphere, it might be applied to several useful purposes. Accordingly, the earth under a part of the laboratory was removed, to the depth of about five feet, and the ground puddled with clay to make it hold water. A large iron pan was then fixed within this prepared bed, so as that it might be entirely surrounded with hot water; and a moveable grating was placed over it. A number of smaller iron pans, each three feet in diameter, were then fixed in the same bed of clay, in a long row against one of the walls of the laboratory. The whole of these being thus

* When these salts are designed for exportation to hot climates, they are deprived of their water of crystallization by the following process:—They are thinly spread upon boarded shelves, in a room heated by steam, to the temperature of 80°, where they are exposed to this warm atmosphere for three or four weeks, until they have sufficiently effloresced, so as to bear being moved with safety to a set of wooden racks fixed over the main boilers, where they are kept in linen bags, in a temperature of 120°, till the whole of the water is abstracted. They are then ground in a mill, to be described hereafter, and when brought to the state of almost an impalpable powder, they are put up in bottles of different sizes, and sold under the name of "Effloresced Alkaline Cheltenham Salts."

fixed, small arches of brick were turned over the remaining parts of the area, for the purpose of supporting the stone floor of the laboratory, which is laid on a level with the edges of the small iron pans just described.

Things being thus situated, an iron cylinder, five inches in diameter, as before mentioned, was fixed in the cover of the large salt pan, to receive the steam and conduct it under the floor of the building, for the purpose of heating the collection of iron pans already named, and producing an evaporation of whatever liquor might be put into them. In order to render the steam effectual for these purposes, the proprietor has contrived that a very small stream of cold water shall meet the large volume of steam exactly in the same spot at which it enters the shallow chamber underneath the laboratory floor; and this has the immediate effect of condensing the whole into a current of hot water. This current, which is never at a temperature below that of 190°, nearly fills the large space beneath the floor, and surrounds the whole of the iron vessels set within it; which are thus preserved at one uniform heat night and day, without any expense of fuel whatever. And when the condensed steam has thus done its office in the laboratory, it flows from thence to the baths of the proprietor, where it supplies one large swimming bath, and eight smaller baths, of various sizes, with a sufficient quantity of hot water to keep them at all times at a temperature fit for use. Not only this, but the hot water is in such abundance, as to occasion these baths perpetually to overflow, and the bathers to enjoy the luxury of a constant accession of fresh water.

There is another advantage which the baths of Cheltenham enjoy, in consequence of their vicinity to these chemical works, and which is known at few watering places in the kingdom; which is, that the visitors who prefer the private baths, whatever may be their number, may all have fresh water every day to bathe in; these baths being so constructed, that they may each of them be emptied in five minutes, and filled again with fresh warm water in ten minutes; and the hot water produced from the steam of the boilers is so abundant, that no person who visits these baths need ever bathe in the water

which had before been used for the same purpose. And that there can be no temptation for deception in this respect, is evident from the consideration, that at this place the hot water is always prepared without expense.

But to resume the account of the preparation of the Cheltenham salts. As soon as the muriate of soda has all precipitated from the mother liquor, the warm mothers are removed to a cold vessel of stone, where a pellicle of a new salt, sulphate of magnesia, soon begins to shew itself, and in six or twelve hours an abundant crop of yellow magnesian sulphate, fully charged with carbonate of iron, is obtained.

The next object is to separate the iron from the crystals of sulphate of magnesia; and to effect this, the workman dissolves them in a large portion of hot water. In this operation the oxygen of the air in the water, uniting with the black oxide of iron, converts this to the red oxide, which renders it insoluble by carbonic acid, and consequently incapable of colouring the salts in their next crystallization.

When the sulphate of magnesia has thus been purified from the iron, and has also been reformed by a second crystallization, it is put into baskets for the moisture to drain from it. As this species of salt is never sold from the Cheltenham laboratory in the form of crystals, the whole of it, when dry, is carried into a set of arches formed in the stack of brick work which supports the range of large boilers; and here it sustains a heat of not lesss than 100°, so that in the course of a few weeks nearly the whole of the water of crystallization will be dissipated.

When the salt has been thus dried, it is carried to a small mill moved by water, and similar to a common corn mill. Here it is ground between two horizontal stones, and reduced to the state of an impalpable powder. It is now considered to be finished, and is sold under the name of the "Effloresced Magnesian Cheltenham salt."

Another salt is still contained in the mother liquor, which is the *muriate of magnesia*, highly charged with iron. In order to turn this to account, the proprietor dilutes it with ten times its measure of hot water and sets it aside to purify. The hot water

instantly acts upon the iron, and as the iron precipitates, it carries all the other impurities down with it. In ten or twelve hours the lixivium becomes bright and nearly colourless, when it is carefully drawn off by means of a syphon, and treated with a solution of carbonate of potash for the production of carbonate of magnesia. But in order to do this in the best manner, the following measures are adopted.

There are five cast iron pans each 24 inches square, if measured at the top; 21 inches square at the bottom and 20 inches deep; in these the American pearl ash, or carbonate of potash, is dissolved by means of hot water. When the solution has been completely effected by repeated stirring, the whole is left for 10 or 12 days at rest, to afford time for the sulphate of potash and other impurities to subside and separate. During this period a large quantity of crystals of sulphate of potash will sometimes attach themselves to the sides of the vessels; but these are all carefully avoided by the operator when he draws off the alkaline lixivium; for if they were to become again dissolved in the liquor, they would not fail to contaminate the magnesia very materially.

When the alkaline lixivium is thus prepared and purified, a small portion of the solution of muriate of magnesia is put into a trial bottle, and some of the alkaline lixivium added to it by degrees, until all the magnesian earth is precipitated. This trial is made for the purpose of ascertaining not only the strength of the solution of muriated magnesia, but also that of the solution of alkali; that the workman may know how much of the carbonate of potash, any given quantity of the solution of magnesian salt will require for its complete decomposition. This having been ascertained, the clear solution of muriate of magnesia is measured into small square pans of iron lined with marble, and the appropriate quantity of the purified solution of carbonate of potash is added to it. This occasions a mutual decomposition of the two salts, and two new ones are produced, viz. muriate of potash which remains in solution, and carbonate of magnesia which precipitates.

When the carbonate of magnesia has entirely subsided, the solution of muriated potash is drawn off with a syphon, and the magnesian earth is washed with several successive portions of

hot water, until the last portion betrays no sign of any salt being dissolved in it The precipitate, which is a carbonate of magnesia combined with water, is then taken out of the vessels and put upon cloth filters to drain. In 24 hours it is usually found to be sufficiently dry to be removed from the cloths, when it is taken to a warm chamber of the temperature of 106° or 110°, and spread out upon shelves made of a porous sandstone, peculiarly well adapted for this purpose. Here, the cakes soon begin to lose their gelatinous appearance, and in the course of about five or six days most of the water which gave this preparation of magnesia the character of a hydrate, will have been absorbed; the carbonate of magnesia is then passed through lawn sieves to prepare it for sale.

Formerly, the solution of muriate of potash which results from the preparation of carbonate of magnesia was suffered to run away as of no value; but it has lately occurred to the proprietor of these works, that it might very advantageously be employed, together with the muriate of soda which is obtained from the spa water, in making a series of warm saline baths, which has long been an important desideratum with many individuals who visit this fashionable watering-place. Accordingly Mr. Thompson has prepared two large reservoirs, each 14 feet by 20 feet, and puddled them at the bottom and round their sides with clay, to make them water tight; and in these he means to reserve from time to time, all the muriatic salts both muriate of soda and muriate of potash which his manufactory shall produce, together with all the spa water which he can spare, until he finds he has a sufficient quantity for the formation of the new salt-baths which he has in contemplation, and which he expects to be able to complete by the commencement of the ensuing season.

When the proprietor of these works found a considerable demand for calcined magnesia as well as for the carbonate, he put up a calcining apparatus for the purpose of preparing it, which we think deserves to be described. It consists of a strong iron cylinder six feet long, with a five inch bore, and which measures in diameter, from outside to outside, 10 inches. This

is fixed in brick work beneath the large salt pan, and passes directly through the fire, from which, it is defended, when not in use, by a row of fire bricks. Within this cylinder the carbonate of magnesia is placed by a bent iron shovel, made on purpose for the work, and which reaches from one end of this calcining oven to the other. When it has thus been filled with the magnesian carbonate, it is closed with an iron stopper; and for farther security a round cover of wrought iron slips upon the end of the cast iron, which makes the whole completely tight. A small orifice is then opened at the other end of the cylinder for the purpose of allowing the escape of the water and carbonic acid; the fire bricks are removed from the fire place, and the calcination commences. In about 3 hours the operation is finished, and every 12 pounds of carbonate produces six pounds of calcined magnesia. When the calcination is finished, if it is not intended to repeat the process, the fire bricks are immediately replaced to preserve the cylinder from the destructive action of the fire at the time when the calcination of magnesia is not going on.

Respecting the origin of the magnesia, it ought to have been remarked, that till within these five years no magnesian salt had even been discovered in any of the spas at Cheltenham. But about the year 1811 the manufacture of the Cheltenham salts, and the increase of visitors at the wells, had occasioned such a scarcity of mineral water, that Mr. Thompson determined to extend the search and to sink some wells at a greater distance from the pump-room, and in a quarter which had not yet been explored. Here he succeeded far beyond his own expectation; and when he came to examine the water of the new wells, he found them to contain not only all the principles of the old spas, but also to hold a considerable portion of muriate and sulphate of magnesia, neither of which salts had ever yet been detected in any of the springs in the vicinity of Cheltenham.

When Mr. Thompson had made this discovery, he determined to keep the water of the new wells separate for the use of the visitors at the pump-room, and to mix them with the waters of the old spas for the use of the manufactory. Accordingly, he

has a distinct reservoir at the pump-room for the magnesian water, and the visitors ask for it under that appellation; whereas it was found necessary to convey it under ground for more than a mile in leaden pipes* to the laboratory. When it arrives there it runs into the general reservoir, and when the whole is sufficiently concentrated by boiling, the various salts are separated, by what the chemist calls priority of crystallization.

Thus, the individuals who visit Cheltenham for medicinal purposes, whatever have been their predilections, may find here a collection of mineral waters which contain the principles of those at Tunbridge, Bath, Bristol, Lemington, Malvern, Harrowgate, and perhaps of every other public spa in the kingdom. To this circumstance it is owing that Mr. Thompson has been enabled to prepare such a variety of different salts from the waters of this very peculiar district; having always on sale six distinct saline preparations, as follow, viz.

I. Crystallized *alkaline* sulphats.

II. Ditto effloresced and ground to an impalpable powder for hot climates.

III. Magnesia sulphate, in a state of efflorescence.

IV. A murio-sulphate of magnesia and iron, in brown crystals, highly tonic.

V. Sub-carbonate of magnesia in powder; and

VI. Calcined magnesia.

It will be observed that in preparing these different articles for sale, there is such a separation of the various principles contained in the original water, that not one of them is similar to the water which is drank at the spa, and more especially, because the whole of the muriate of soda is thrown aside and employed in preparing the saline baths.

From these considerations we have judged it advisable to

* While examining the various processes for preparing the salts, the proprietor told us that he had formerly employed pipes of iron and also of wood, but that the one occasioned a turbidness in the water, and the other rendered it vapid and unpleasant; which reduced him to the necessity of substituting lead. But having intimated a doubt to him as to the safety of using it, we requested to see one of

recommend Mr. Thompson to fill one of his salt-pans with water from one of the magnesian wells, and having evaporated the aqueous part and obtained all the solid matter contained in it, to grind these mixed chalybeated salts together and offer them for sale under the name of the "original combined Cheltenham salts." We have advised this, because we conceive that the muriate of soda, which has hitherto been separated, and also a larger complement of the oxide of iron, may, for some constitutions, be very salubrious. Moreover, if this were done, all persons residing at a distance might at all times and in all seasons prepare a medicated water for themselves, which would possess nearly every property of the real Cheltenham waters. This Mr. Thompson has determined to carry into effect, as a matter of experiment, not doubting but that the various professional men who are in the habit of purchasing his salts, will soon make their report upon its value, when compared with the virtues of his other salts.

A careful analysis of the several waters of Cheltenham has afforded the following results.

No. I. The strong chalybeate saline water; the specific gravity of which is = 1,0092.

these pipes of conveyance taken up, that we might examine it. Accordingly, a leaden pipe which had lain in the ground for ten years, and had had a thousand gallons of mineral water pass through it every 24 hours, was removed from its situation for this purpose, and when it was slit open, it appeared to have a very slight coating of oxide of iron; but we could not perceive that the lead was at all eroded by the action of the water. For further satisfaction we referred the proprietor to the very respectable testimony of Dr. Jameson, who in his ingenious treatise on the Cheltenham waters has shewn the impropriety of using pipes of iron, and has informed us that "one half of the old well at this watering place is *lined with lead*;" and though he superintended its being opened to be cleansed in the year 1802, makes no observation on the fact of lead being employed; which he doubtless would have done if he had conceived that it was improper. See Jameson's Treatise on Cheltenham Waters, 1st edit. 1803, pages 56 and 62.

One wine pint contains 74 grains of dry salts,* consisting of

	Grains.
Muriate of soda - -	41,3
Sulphate of soda - -	22,7
Sulphate of magnesia - -	6,0
Sulphate of lime - -	2,5
Carbonate of soda and iron	1,5
	74,0

The pint yields about 2,5 cubic inches of carbonic acid gas. This water, after the carbonic acid has been separated, renders the yellow of turmeric slightly brown.

No. 2. The strong sulphureted saline water. Its specific gravity, after the separation of the gases, = 1008,5.

One pint affords on evaporation 65 grains of dry salts, containing

	Grains.
Muriate of soda - -	35,0
Sulphate of soda - -	23,5
Sulphate of magnesia -	5,0
Sulphate of lime - -	1,2
Oxide of iron - -	3
	65,0

Gaseous contents.

	Cubic Inches.
Sulphuretted hydrogen -	2,5
Carbonic acid - -	1,5
	4,0

This water possesses the fetid odour of sulphuretted hydrogen. It renders tincture of galls slightly black, and a piece of gall nut suspended in it becomes surrounded with a blueish cloud.

No. 3. The weak sulphuretted saline water. Specific gravity after the loss of its gaseous contents = 1006.

* After having been kept for six hours at a temperature of 212°.

A pint affords 36 grains of dry salts, consisting of

	Grains.
Muriate of soda -	15,0
Sulphate of soda - -	14,0
Sulphate of magnesia -	5 0
Sulphate of lime -	1,5
Oxide of iron - -	5
	36,0

Gaseous contents.

	Cubic Inches
Sulphuretted hydrogen -	2,5
Carbonic acid - -	1,5
	4,0

No. 4. The pure saline water, specific gravity = 1010.

One pint affords on evaporation 80,5 grains of dry salt, which is composed of

	Grains.
Muriate of soda - -	50,0
Sulphate of soda - -	15,0
Sulphate of magnesia -	11,0
Sulphate of lime - -	4,5
	80,5

This water scarcely yields any traces of iron.

No. 5. Sulphuretted and chalybeated magnesian spring, or bitter saline water.

Specific gravity after the loss of its gaseous matters = 1008.

One pint left a residuum on evaporation of 60 grains of dry salt, consisting of

	Grains.
Sulphate of magnesia -	36,5
Muriate of magnesia -	9,0
Muriate of soda - -	9,5
Sulphate of lime - - -	3,5
Oxide of iron - - -	0,5
Loss - -	1,0
	60,0

Gaseous contents.

		Cubic Inches.
Sulphuretted hydrogen	-	1,5
Carbonic acid	- -	4,0
		5,5

No. 6. Saline chalybeate drawn from the well near the laboratory.

Specific gravity after the loss of the carbonic acid = 1004.

One pint affords 34 grains of dry salts, containing

		Grains.
Muriate of soda	- -	22,0
Sulphate of soda	- -	10,0
Oxide of iron	- -	1,5
Loss	- - -	0,5
		34,0

Gaseous contents.

Carbonic acid about 10 cubic inches.

The waters No. 2 and 3 are pumped from the same well, but the suction pipe that raises No. 2 passes to the bottom, while that of the pump furnishing No. 3 dips only about three feet into the water.

As there is no spot in Great Britain which furnishes such a variety of mineral waters, and is so much resorted to by valetudinarians as the neighbourhood of Cheltenham, we have considered it necessary to be somewhat minute in our account of the methods adopted in the preparation of the various products above described, and also in the analyses of the different waters of the springs. We trust that the information we have been able to communicate will prove interesting to those who visit the district, and useful to such as may be engaged in similar objects of inquiry, and are happy in this opportunity of expressing our obligations to Mr. Thompson for the ready access which he gave us to his laboratories, and the assistance he lent to our pursuits.

London, March 8, 1817.

Art. V. *An Account of* Euler's *Method of solving a Problem, relative to the Move of the Knight at the Game of Chess. From a Correspondent.*

The Knight being placed on any given square of the chess-board, it is required at sixty-three successive moves, to cause it to move over the remaining sixty-three squares.

To most of those who are familiar with the Game of Chess, this curious question is perhaps well known, although the method of reasoning which Euler employed in discovering its solution, is, I believe, not so generally understood.

It may be remarked, that if we have any one course of moves, by which the knight may successively move over the sixty-four squares of the chess-board, and if the square with which it terminates, is distant from the square which commenced it, by one move of the knight, then, such a course will solve the problem; the course given, fig 1, Plate II. is of this nature, and may be called a re-entering-course.

Let us now suppose the knight is placed on the square marked 39, (fig. 1, Plate II,) then, since we are acquainted with this course, we may cause it to move on through the squares 40.41 . . &c. 64, and since it can move from the square marked 64, to that marked 1, it may continue its course from 64 to 1 . 2 . 3 . . . to 38, when it will have fulfilled the conditions. This course may conveniently be represented thus:

39 . . . . 64.1 . . . . 38.

It also appears, that the knight might have moved backwards from the square 39 to 38, and so on to 1, and from thence to 64, then through 63, &c. to 40. This course would be thus represented:

39 . . . . 1.64 . . . . . . 40.

The arrangement just given, furnishes, therefore, two courses from whatever given square of the chess-board the knight commences his course.

As it is a much more difficult matter to discover by trial, a re-entering course, than one in which the last square does

not communicate with the first, we shall first show a simple method of transforming any course of the latter species, into several different ones of the former kind. Let us take the course (fig. 2, Plate II,) in which the last square, 64, does not communicate with the first, 1. It may be remarked, that the square at which the knight finishes his course, may be changed in several ways, without altering the square from which he started; thus let us notice all the squares to which the knight might move from the last one, or that marked 64: these squares are 63, 31, and 51, of which the first, or 63, contains the move already employed, to arrive at 64, and is therefore of no use. Since the knight can move from the square marked 31, to that marked 64, let him make this move on his arrival at 31, after having passed through the squares 2. 3, &c. and after that let him pursue his course through the squares 64, 63, 62, &c. until he arrives at 32, which will now be the last one, and his new course will be represented thus:

1.2 . . . . 31.64.63 . . . . 32.

In a similar manner the move from 64 to 51, gives the course

1.2 . . . . . . 51.64.63 . . . 52;

and since the last square, 52, communicates by one move with the first, 1, this course is one of the re-entering kind, and it is, in fact, the course already given. If we had not already found a course of this kind, we might make new transformations on those just given. Thus, in the course

1 . . . . . 31.64 32,

the knight can move from the last square, 32, to the squares 43, 11, 31, 33. The number 43 gives the course

1 . . . . . 31.64 . . . . . 43.32 . . . . 42.

The number 11, furnishes the course

1 . . . . 11.32 . . . . 64.31 . . . . 12.

The third number, 31, gives the original course from whence we began, aud the number 33 causes no change.

In the last course, which ends with 12, the knight may move from 12 to 59, 41, 11, and 13; these furnish the following courses:

1 . . . . 11.32 . . . . 59.12 . . . 31.64 60

1 . . . . 11.32 . . . . 41.12 . . . 31.64 42

and since 60 communicates with the squares 61, 59, 9, 45, 25, 27, 13, and 53, we shall have several new courses ending with 10, 26, 46, 28, 14 and 54.

We have thus an easy method of discovering a great variety of new courses, from one given one, and this number might be much increased by inverting the order of each course.

This method of discovering re-entering courses, requires us to be acquainted with one which does not possess that property; now such a course may be determined in the following manner: beginning with any square, let the knight be moved successively over as many squares as he can, marking each square with a number; those squares which remain vacant, may be marked with the letters of the alphabet, as in fig. 3. In this case there remain two squares unoccupied, which are marked *a* and *b*. The course of the knight having moved over 62 squares, may be represented thus:

1 . . . . 62;

and considering 62 as the last square, let us transform this into other courses which terminate with other squares, until some of the final squares communicate by one move of the knight, with either of those marked *a* and *b*; but 62 communicates with the squares 9, 53, 59, 61, 23, 11, 55, and 21, whence we may deduce the transformations.

I. 1 . . . . 9.62 . . . . 10, which communicates with *a*.
II. 1 . . . . 53.62 . . . . 54, which communicates with *a*.
III. 1 . . . . 59.62 60
IV. 1 . . . . 23.62 24
V. 1 . . . . 11.62 12
VI. 1 . . . . 55.62 . . . . 56, which communicates with *a*.
VII. 1 . . . . 21.62 . . . . 22.

The courses marked I. II. and VI. include the square *a*, and by applying similar transformations to either of them, we may obtain others, which also include *b*; such is the following:

1 . . . . 9.62 . . . . 58.*a*.10 . . . 57.6

which arises from transforming

1 . . . . 9.62 , . . . 10.*a*

into 1 . . . . 9.62 . . . . 58.*a*.10 5

where 57 communicates with *b*.

It is obvious, that the same method is applicable, whatever be the number of squares unfilled at the beginning; and the course thus obtained, may be transformed by the process explained at the commencement of this Paper, into others which have the property of returning into themselves: such are the figures 4 and 5.

After solving the question in the manner we have just stated, Euler adds to it, the following restriction, which renders it still more curious. It is required, that the difference of the numbers which are placed in any two *opposite* squares, shall always be equal to 32. Note, each square has another which is opposite to it, and the two squares are so related, that a straight line drawn through their two centres, will always divide the chess-board into two equal parts. It is therefore required in this case, that the squares which contain the numbers 32, 33, 34 . . . . 64, shall be opposite to those in which the numbers 1, 2, 3, ... 31 occur.

In order to discover such courses we must put 1, 2, 3, &c. in the squares successively covered by the knight, and at the same time we must write the numbers 33, 34, 35, &c. in the opposite squares; continuing this as far as we are able, we shall find twelve squares remain empty, which may be filled by the letters A, *a*, B, *b*, C, *c*, D, *d*, E, *e*, F, *f*, arranged in opposite squares, as in figure 6.

We have here two separate series of squares, which indicate the successive moves of the knight:

58 . . . . 64.1 19
29 51

The square 19 communicating with 6, gives the transformations

51 . . . . 64.1 . . . . 6.19 . . . . 7.*f*. B. *d*. C.
26 . . . . 38.51 . . . . 39. F. *b*. D. *c*.

Since C communicates with the squares 8, 6, *d*, of the first series, it will furnish no new transformations; let us therefore omit the two last terms; and since it is sufficient to transform one series, because the other is determined by it, let us consider the series

58 . . . . 64.1 . . . . . 6.19 . . . . 7. *f*. B.

where B communicating with 12 gives the course

58 . . . . . 64.1 . . . . 6.19 . . . 12. B.*f*. 7 . . . 11. D. *c*.

but since *c* communicates with 16, we have

58 . . . . 64.1 . . . 6.19 . . . . 16.*c*.D.11. . . . 7.*f*.B.12. . . .15.*a*.E.

and the other series will be

26 . . . . 38.51 . . . . . 48. C. *d*. 43 . . . 39. F. *b*. 44 . . . 47. A. *e*.

which comprehends all the squares.

We must now endeavour to connect these two series together, so that the end of one shall communicate with the beginning of the other; for this purpose we observe, that E communicates with 62, and that the first series will then end with 63, which communicates with 26, the beginning of the other series; this transformation gives

58 . . . 62.E.*a*.15 . . . 12.B.*f*.7 . . 11.D.*c*.16 . . 19.6 . . . 1.64 . 63
26 . . 30.*e*.A.47 . . . 44.*b*.F.39 . . 43.*d*.C . 48 . . 51.38 31

and we have a re-entering course, which possesses the required property; see fig. 7.

To the condition respecting the opposite squares, we may also add the following: that the first half of the numbers 1 . 2 . . . 32 shall be contained in the first half of the chess-board, supposing it divided into two equal parts by a line parallel to one side passing through the centre; thus in fig. 8, all the numbers 1 . 2 . . . 32 must be situated below the line $\alpha\ \beta$, and all the other numbers above it. Let us begin by putting unity on one of the squares adjacent to the line $\alpha\ \beta$, then 33 must be placed on the opposite square, and causing the knight to move from 1 through various squares of the lower half of the chess-board, we arrive as far as 28; the remaining squares must now be filled up with the letters *a*, *b*, *c*, *d*, and these must, by various transformations, be included in the course: after several changes we may arrive at the following, which includes them all;

1 . . . 8.23. . . . 21.18 . . . 20. *b*. 24 . . 28.17 . . 9. *a*.*c*. *d*.

and this again may be transformed into

1 . . . 8.23 . . . 21.18 . . 20.*b* . 24 . . 28.17 . . 15.*d*.*c*.*a*.9 . . .14

in which 14 communicates with 33, the beginning of the series above the line $\alpha\ \beta$, and the end of that series 64 also

communicates with 1; so that we have a re-entering series subject to both the restrictions.

The whole course is represented in Fig. 9.

It is not difficult to find other similar ones by the same method; and this course might be transformed in several ways, some of which are,

7 . . . 1.8 . . . 32

7 . . . 1.8 . . . 25.32 . . . 26

15 . . . 10.7 . . . 1.8.9.16 . . . 21.24 . . . . . 32.23.22

II.

Art. VI. *Some Experiments and Observations on a new Acid Substance.* *By* M. Faraday, *Chem. Assistant in the Royal Institution.*

Sir H. Davy, during his investigations on flame, discovered a method of exhibiting those combinations of bodies, which he had ascertained to take place at temperatures below that sufficient to inflame them; and whilst pursuing his enquiries on these new and singular phenomena, observed the formation of a peculiar acid body from ether. He has mentioned this body in a Paper read before the Royal Society, which will shortly be published; and he requested me to make some experiments on this substance, the results of which I shall now at his desire detail.

When a fine platina wire is heated and placed over the surface of ether, in an open glass, a pale lambent flame plays around it, and peculiar pungent fumes arise. Generally the heat of the wire is increased; it becoming at last red, and even white hot, and frequently inflaming the ether. If a heated glass or earthen-ware rod be placed over the surface of the ether, the pale flame is seen, and the vapours arise, but the effect soon ceases, from the cooling of the heated substance. The production of these fumes takes place at all temperatures, from a heat a little above the boiling point of mercury, until the ether is inflamed.

The vapours are very acrid and pungent, and very much resemble chlorine in smell: they affect the eyes in a manner similar to azotane: they redden moistened litmus paper. When a rod dipped in ammonia is held in them, they combine with the alkali, producing white fumes.

Sulphuric ether produces them most abundantly, but they may be obtained from the other ethers also. When nitric ether is used, as it inflames at a much lower temperature, it is more difficult so to manage the wire, as to produce the vapours: but if it be previously mixed with solution of potash, or other alkalies, then it succeeds as well as sulphuric ether, and the vapours formed, being unmixed with any nitrous vapours, are unequivocal in their characters.

Muriatic ether mixed with potash also produces the peculiar vapour, but not so abundantly as sulphuric or nitric ether. The wire easily retains its temperature, but does not very often inflame the fluid.

Acetic ether requires to be warmed before it will succeed well in preserving the wire at a red heat; and I have never yet observed the formation of the acid fumes from it.

I endeavoured to obtain a quantity of the acid in a pure form: for this purpose, some ether was thrown into a bladder, which was then filled with common air, and the mixture of air and vapour made to traverse a heated glass tube, containing pieces of platina wire and foil; the end of the tube descended into a bottle placed in a freezing mixture, and after passing many bladders of air slowly through the tube, the results were examined. Some charcoal remained on the pieces of platina; much carbonic acid had been formed and dissipated; and there was found in the bottle an aqueous solution of the peculiar acid.

The quantity obtained in this way, even after the process had been continued for some hours, was very small. The solution was clear and colourless, of a slightly acid taste and strong irritating smell. It reddened litmus paper, as did also its vapours. When heated the acid was quickly dissipated, leaving, on being evaporated to dryness, a slight coally mark on the capsule.

I distilled some of the solution from fused muriate of lime, hoping to procure the acid in its pure form, but obtained no decisive results. No permanent gas was given off, nor did any fluid distil over, until the acid was decomposed by the heat; but the quantity was too small to present distinct phenomena.

The solution of the acid added to ammonia, combined with it and formed a neutral salt, which, by careful evaporation, was obtained in the solid form. This was very volatile, rising at temperatures even below that of boiling water, and producing a peculiar fœtid smell, not much like the acid, but quite as unpleasant.

Muriate of lime decomposes the carbonate of ammonia, a triple muriate being formed, and carbonic acid separating; and as the new acid appeared to possess affinities in some cases not even so strong as those of carbonic acid, I hoped to obtain it pure by a similar decomposition; but on making the experiment, was still unsuccessful. The salt being distilled with fused muriate of lime, nothing came over but a small quantity of a fluid, possessing no acid properties, and appearing to be water: a decomposition had however taken place; for, on increasing the heat, ammonia was driven over; but here, as before, the small quantity I could use was against the experiment.

The acid solution added to potash and soda saturated them, and rendered them neutral. The solution with potash bore the application of heat for some time, until a certain degree of concentration being obtained, it began to decompose, and soon became strongly alkaline, the acid flying off. When in this state, if suffered to cool, it crystallised; and if left exposed to the air, soon deliquesced. If evaporated to dryness and heated, the subsalt was decomposed, and the acid destroyed.

The neutral alkaline solutions precipitated salts of silver and mercury, but not of other metals: the precipitates were soluble in a large proportion of water.

The acid solution decomposes the carbonate and subcarbonate of potash, soda, and ammonia, giving off carbonic acid:

it also decomposes the bi-carbonate of magnesia. It has no action on the carbonate of lime, even when newly precipitated; and in several other cases I have thought its affinities were weaker than those of carbonic acid.

The salts which it forms with the alkalies are decomposed by the common acids, and the peculiar vapour flies off; so much however is generally decomposed by the acid or heat (if evaporated), as to discolour the residuum.

From the small quantities in which I have been able to form it, I had no hope of ascertaining the proportion of its constituent parts; but from some minute experiments, I judge it to be composed of oxygen, hydrogen, and charcoal. A neutral solution of it with potash was evaporated to dryness and distilled, 2.17 cubical inches of gas were received over mercury, and much charcoal remained with the alkali in the retort. The gas rendered lime water turbid, and being agitated with solution of potash, became 1.6 cubical inches. This was inflammable, and burned with a light flame; four volumes of it detonated by the electric spark with six of oxygen, became two, which with four of nitrous gas became two; so that it appeared to be a mixture of carbonic oxide and hydro-carbonate. Oxygen, hydrogen, and charcoal may therefore be considered as the elements of the acid: the latter, from the quantity left in the retort, appearing to be in very great proportion.

The peculiar character of this acid is the irritating effect it produces on the eyes and nostrils. In this it somewhat resembles the oxalic acid, but is more pungent. This character belongs in part to its salts; at least its combination with ammonia, when volatilised, possesses similar powers, though not so strong

Among other fruitless attempts to obtain it, I used an atmosphere of oxygen and carbonic acid in place of common air, and receiving the gas over mercury, was in hopes of separating the carbonic acid by lime or some other agent, which would leave the new acid. I also distilled the neutral solution of it with potash, until rendered alkaline; but the very small quantities in which it is formed, and the ease with

which it quits its compounds, have prevented the performance of any decisive experiments upon it; and until some other process has been discovered for producing it, there is little hopes of its being obtained in the pure state.

Art. VII. *Natural and Statistical View of Cincinnati and the Miami Country.* *By* Daniel Drake. Cincinnati, 1815.

Cincinnati, the metropolis of the Miami country, within the Ohio state, is situated on the northern bank of the Ohio, 7° 24′ 43″ west of Washington. The Ohio state lies along the right bank of the river from which it takes its name, and its soil is the richest of North America; and is bounded by Pensylvania, Virginia, and Kentucky, the Indiana and Michigan territories, and Upper Canada. This state was admitted into the Union in 1803. The capital is Chilicothé, about sixty miles up the Ohio.

It was not till the year 1788 that any settlement was begun within the present limits of the state of Ohio, in which year settlements were commenced, and were extended along the Muskingum and Miami rivers, but which, till the Indian treaty of Greenville in 1795, they proceeded slowly: the causes, however, which precluded a rapid increase of population being removed, the advancement of both the population, and the extent of land brought into cultivation, since that time, has been beyond example; the former amounting to more than 300,000, and the latter extending over nearly 20,000 square miles, already rising in many parts to refinement.

Of the different towns in this state already far advanced, Cincinnati is one of the most important, and one which has already made the most rapid strides in the extended course of civilization of this part of the American continent. We consider Mr. Drake's work one of considerable interest: he has with great good sense and apparent care furnished the outlines

for a natural and statistical history of this important state. Independent of its intrinsic merit, the work is of peculiar value, inasmuch as it affords of itself direct proof of the progress which that country has made in improvement; and furnishes in every page satisfactory evidence of the wisdom of the American government, in the rules they have laid down for the happiness of its citizens. With this preface, we shall present to our readers such information from this work as we think most deserving of notice, and as our limits will admit.

In the Ohio state the soil is fertile, the price of lands low, the title to it secure, slavery excluded, and labour dear. The following is stated as the geometrical ratio of increase of population of the Tennesee, Kentucky, and Ohio states, lying nearly in the same meridian, and equally distant from the parent states. Tennesee, from 1791 to 1800, increased at $12\frac{3}{4}$ per cent. per annum (doubling in six years); from 1800 to 1810, at $9\frac{1}{2}$ per cent. per annum (doubling in eight years); and since at a diminished rate, which will take about eleven years to double. Kentucky, from 1790 to 1800, increased at $11\frac{6}{10}$ per cent. (and doubled in less than seven years); from 1800 to 1810, at $6\frac{3}{10}$ per cent. (doubling in eleven years); and since at a diminished rate, which will require, for the period of doubling, about twenty-three years. In Ohio, from 1790 to 1800, the population augmented at the rate of $30\frac{1}{4}$ per cent. (doubling in less than three years); from 1800 to to 1810, $18\frac{1}{2}$ per cent. (nearly doubling every four years); and since 1810 the probable rate is, that it will be again doubled in ten years.

The state is divided into counties, each of which has already its county town, which is described; and each town has a printing-office, court-house, and post-office, with public buildings; and most of them publish a weekly paper.

The grains are, Indian corn, wheat, rye, oats, and barley, yielding of the first, in some cases, one hundred bushels per acre, and on an average, forty-five; wheat is generally raised, and well adapted to the climate, twenty-two bushels the average, and the maximum forty: the weight 60lb. per bushel. Cider is made in large quantities; hemp and flax are grown;

the meadows are luxuriant; white clover and spear grass are the most generally cultivated, yielding two tons per acre; the pastures admirably adapted to cattle and sheep; and hogs are fattened on the fleshy roots of the prairie. Agriculture must, for the present, be considered as in its infancy.

In ascending from the surface of the Ohio, when low, to the top of an adjoining hill, first a region of tabular limestone, and argillaceous slate is observed; then a tract of alluvion compound of loam and clay, succeeded by a tract of the same kind more ancient, consisting of sand and gravel; the same strata are found exhibited by the bed of the river, surmounted by a stratum of loam, supporting occasional masses of primitive rocks.

The calcareous or limestone region is the largest perhaps in the known world. Parallel to the meridian, it extends, with few interruptions, but with considerable variations of character, from the shores of Lake Erie to the southern part of the state of Tennessee, and probably to the cape of East Florida, as the rocks of the celebrated reef, bordering that promontory, are stated to be calcareous. From the Muskingum and Great Sandy on the east, this formation extends westward beyond the state of Ohio; but to what distance, has not been ascertained. After passing the Great Miami, in this direction, the strata become disjointed, and lose their continuity, but show themselves, occasionally, even beyond the Mississippi.

The strata throughout this extensive region agree in having a horizontal position, and in containing marine remains. The lime afforded is of sufficient strength, but dark, and is in strata from one to eighteen inches thick, alternating with layers of clay slate. Good iron ore has been found, and specimens of silver ore have been dug up. The alluvial formation of this country is the exclusive depository of the remains of the huge quadrupeds, now unknown; the granite and other primitive rocks, are found in blocks on the surface, sometimes solitary, and at others piled in large masses. The question how these primitive rocks became transported, is a subject of much theoretical speculation: the country north of the great lakes is represented by Mr. Mackenzie as granite; the

secondary strata of this region indicate it to have be once a sea, and the declivity from near the lakes to the Gulph of Mexico favours the supposition, that at some former period there were currents over this part of the continent from north to south, and by these currents the masses of primitive stone may have been brought down embedded in ice and deposited where they now are. The climate of the Miami state participates with all those adjacent; the average state of the thermometer is 54; the winters in general mild, though the Ohio is occasionally shut up by ice.

The Ohio countries have been considered warmer in the same parallels than the Atlantic states, by Mr. Jefferson, Volney, and several other writers. This idea is combated by Mr Drake at some length, and he appears to have very diligently collected several curious facts relating to the climates of the two regions, and concludes, that though there is a difference in the climates, it consists more in the distribution than the absolute quantity of heat.

North America is traversed by two ranges of high mountains, the Allegheny and Chippewau. They are found near the eastern and western sides of the continent, widely separated; but resemble each other in diverging from the meridian, in opposite directions, at the same angle, in lying about equal distances from the Atlantic and Pacific oceans; and in preserving, throughout their whole extent, a parallelism with the coasts, to which they are respectively contiguous. The western, or Chippewau range, is the highest and most extensive; originating near the arctic circle, and spreading into elevated table land in Mexico. The Alleghenies commence immediately south of the Gulph of St. Lawrence, in the 48th degree of north latitude, and are lost in the 34th or 35th degree between the state of Georgia and the Mississippi river. In the latitude of Cincinnati, these ranges are about 1300 miles asunder. The intermediate country is bounded on the south by the Gulph of Mexico, and on the north by a chain of lakes stretching to the north-west, from the 42d to the 60th degree of latitude.

From this arrangement of mountains and lakes, results a division of North America into several great regions: 1. The mountainous,

consisting of two distinct and distant ranges; neither of them so high as to be covered with snow in the summer. 2. The western maritime, lying along the Pacific ocean. 3. The eastern maritime, extending from the Alleghenies to the Atlantic ocean, and naturally divisible into three sections; the northern, middle and southern. The rivers of the first, run nearly from north to south; those of the second and third, from north-west to south-east, leaving the mountains at right angles. 4. The lakes, and immense wilderness situated beyond them. 5. The valley or basin of the Mississippi, bounded on the west, east, and north, by the regions just named. Being thus surrounded, the climate of this extensive tract must necessarily participate of all those which are adjacent. The mountain districts produce some of its peculiarities; but more are perhaps attributable to the region of snow and ice and half frozen lakes, in the north.

Considered without reference to the others, the central or Mississippi district, may be characterized as a plain from 800 to 1000 feet above the ocean, depressed in the middle from north to south, cut in various directions into numerous vallies, by streams of every width, generally covered with trees in the eastern, and with herbaceous plants in the western parts; arid and rolling in the south-east; dry and level in the west; marshy to the north, and wet to the south.

The prevalent winds of the interior, come from between south and west. Some of them are from the Gulph of Mexico, but the greater number appear to consist of air which in conformity to a general law, is moving eastwardly, and suffers deflection to the north by the vallies of the Mississippi and Ohio. The winds between north and west are next in prevalence, and consist of two varieties; that which attends or follows thunder gusts and other storms, and is supposed by Mr. Volney to descend from the higher regions of the atmosphere; and that which comes from beyond the sources of the Mississippi, and frequently continues for several days. The prevailing winds of the middle Atlantic states are between west and north. They consist of the real north-west, which traverses the lakes and loses much of its rigor, which however, it reacquires in ascending the Alleghenies, of the mountain or alpine atmosphere, frequently rolled

down towards the ocean, and of the south-west wind of the interior, converted by the vallies of the eastern rivers into a direction north of west. The west wind of both regions possesses nearly the same qualities; but from having traversed an additional range of mountains in reaching the Atlantic states, must be colder and drier there than in the interior. The east, south-east, and north-east winds of the Atlantic states, taken together, prevail more, and are warmer and damper than in the interior.

The violent north-east and south-east storms of the Atlantic states, are unknown in the western. In the quantity of water that falls in the two regions, there is probably not much difference. The south-west wind is the cause of great rains in the latter, and the north-east of still greater, perhaps, in the former. In the latitude of the Ohio state more rain falls west of the mountains, and more snow east of them. In the interior there is more cloudy weather, and greater atmospheric humidity. In thunder gusts, and other electrical phenomena, in droughts, and in the periods at which most agricultural operations are performed, there is perhaps no material difference.

The plan of Cincinnati is laid out partly on the plan of Philadelphia; the main streets are 66 feet wide, and the value of property in every part of the town is daily increasing: it is advantageously situated for procuring every material for building; the bed of the Ohio affords excellent limestones; fine marble is brought by water from the cliffs of Kentucky river; free stone of a good quality is already freighted for a small sum from near the intersecting of the Scioto with the Ohio. Clay for bricks, and lime and timber are abundant. In 1815 there were already built 1100 houses, of which, besides other buildings, 20 were stone and 250 brick; ornamental buildings were began; water and wood for fuel are abundant: coal brought from Pittsburgh is only used in manufactures. The markets, which are numerous and frequently held, are well supplied. There is no iron foundery, but the town is well supplied with iron, manufactories of cotton, and every other article of domestic consumption abound and are rapidly increasing; and in 1815, large quantities of manufactures were exported. A considerable manufacturing company is established; flat bottomed boats and

barges are employed on the river in commerce, but steam boats are already beginning to be worked. Flour, pork, and spirits are the chief articles of exportation; there are three banking companies, three weekly papers. One 36th part of the state lands has been granted by the general government for the use of schools, and large national Lancasterian schools have been opened; a public library has also been established.

Pleurisy and Peripneumony are the most frequent diseases in winter, and are generally complicated with bilious affections: colds and other affections of the throat produced by change of weather are common: the premature decay of the teeth and pains in the jaw, which in parts of North America constitute an eighth part of the diseases, are not here prevalent: remitting and intermitting fevers prevail in autumn, especially along the water courses. The cholera infantum is more fatal to children than any other complaint; next come convulsions and croup.

Of adults, the greatest number die of bilious and typhus fevers; with pulmonary inflammation, and with affections of the liver, stomach, and bowels.

It may reasonably be presumed, supposing population to increase in its present ratio, that many of the villages which have sprung up within 30 years, on the banks of the Ohio and Mississippi, are destined, before the termination of the present century, to attain the rank of populous and magnificent cities. A reference to the importance of the Mississippi in the American continent, renders this supposition plausible; the vast extent and number of its branches (many of which exceed in length the largest rivers in Europe); the general direction of the main trunk, nearly from north to south, passing through more than 15 degrees of latitude in the temperate zone, the diversities of aspect, and inexhaustible fertility of the region which it irrigates; the boundless and perennial forests, which in the east, and in the north, overshadow its sources; the numerous beds of coal and iron which enrich its banks; the reciprocal ties and dependencies, which can never cease to operate, between the inhabitants of its upper and lower portions; the numerous states which will possess in its navigation, a common interest, that must for ever constitute a bond of political and commercial amity.

Of all the ramifications which enter into the composition of the Mississppi, the Ohio will unquestionably retain for ages, the highest rank. Mr. Drake, with an enthusiasm and a partiality natural to every patriotic citizen, observes, " our Atlantic brethren will behold with astonishment, in the green and untutored states of the west, an equipoise for their own. Debarred, by our locality, from an inordidate participation in foreign luxuries, and consequently secured from the greatest corruption introduced by commerce, secluded from foreign intercourse, and thereby rendered patriotic; compelled to engage in manufactures, which must render us independent; secure from conquest, or even invasion, and therefore without the apprehensions which prevent the expenditure of money in solid improvements; possessed of a greater proportion of freehold estates than any people on earth, and of course made industrious, independent and proud; the inhabitants of this region are obviously destined to an unrivalled excellence in agriculture, manufactures, and internal commerce; in literature and the arts; in public virtue, and in national strength!"

It was reserved for the Americans to decide, by their conduct and example, the important question—whether societies of men were really capable of establishing good government from reflection and choice; or whether they were for ever destined to depend for their political institutions on accident and force ?——We do not think an account of the natural and civil condition of an infant state, in the interior of a remote continent, as out of place in a Journal of Science: we have indulged ourselves in details respecting its political state, because, convinced as we are, that the cultivation and advancement of science and the arts depend on the safety and happiness of individuals, which can only be secured by civil and political freedom, we persuade ourselves that such details will not fail to interest our readers.

Art. VIII. *Lithography. To the Editor.*

The art of printing on stone was first introduced into this country about fifteen years ago, by a person of the name of André, who obtained a patent for the invention, but which, of course, could not have been sustained, as the art had been

long practised on the Continent. Several sketches were made by our eminent artists, and a periodical work was published by M. André, of impressions from stone, and which, on his leaving this country, was continued by Mr. Volwieler, his successor, who finding the profits fall short of his expectations, left this country some time since; and on his departure, a poor person of the name of Redman, who had been in the employ of M. Volwieler, was instructed by him in the process, and was engaged in the Quarter-Master-General's office, for the purpose of printing plans, &c. The hope of greater gain, tempted him to quit his situation He has not however, I believe, reaped, as yet, much profit from the concern. Some others have constructed presses, and printed from stone, but Redman is unquestionably the most skilful workman. When this art was first introduced into this country, it was expected that considerable benefit would result from its practice. In many instances, the expense attending engravings, precludes the possibility of giving publicity to works on science, and in others, considerable sacrifices are made, in order to bring out works which, but for the expense of the engravings, might have yielded the author a return for his labours. It should seem, however, from the total want of encouragement this art has met with here, either that it is not fit to supply the place of copper-plate engravings, or wood-cuts, or that the difference of expense is so inconsiderable, as not to be of moment. It was said, that the engravers had united to prevent the art being brought into use in this country. It is however, of course, a matter of absurdity to suppose, that the few members of any particular trade, should be able to prevent the exercise of an art, by which that which is required, could be procured equally serviceable, at one tenth part of the price. The fact is, the art of printing on stone does not appear ever to have been practised in perfection in this country, as will appear by reference to the works after noticed. The short outline of the process appears to be as follows. A slab of white lias, (Bath stone) about an inch thick, is rendered perfectly level, and polished with fine sand, or some other sub-

stance, and this stone is drawn on with a pen, and a prepared liquid of the consistence of common ink, and with the same facility: after this, the stone is washed over with a diluted nitric acid, which slightly corrodes that part of the stone which has not been drawn on with the pen (the liquid repelling the acid, having wax in solution); and the stone is then saturated with water, and the common printing ball is dabbed over it, as in type printing, and the ink adheres to such parts as have been drawn on, (the other parts of the stone being wet, repel the printing ink); the impression is then taken by passing the stone through a press, with a single cylinder. When the print is wished to resemble a chalk drawing, the stone is left rather rough, by using a coarser sand to polish it; and instead of ink and a pen being used, a prepared pastil, of the same substance as that with which the mixture used in drawing with a pen is made, is substituted, with which a drawing is made on the stone. From this, it appears, that the making the drawing on the stone, is accompanied by no more inconvenience than a drawing on paper with pencil or a pen: but as circumstances may render it inconvenient to make the drawing on the stone, there is a prepared paper, on which the drawing may be made, either with a pen or chalk, and which the printer can transfer on the stone; and this method has the advantage of reversing the drawing, by which means, the impression produced, corresponds with the original design. As it is difficult, even with a steel pen, to make a very fine line on the stone, where that is requisite, it is better to cover the stone over with a thin mixture of gum-water and lamp-black, and after it is dry, the design may be sketched with the point of an etching needle, in the same way as on copper, scratching through the covering of gum, and then rubbing the printing ink on the surface of the stone; it only adheres in the parts where the gum has been scratched away, and when the stone is soaked in water, the gum dissolves and washes off, leaving the design traced in printing ink on the stone, which, when dry, is printed from in the mode before mentioned. It should seem, however, that notwithstanding the apparent

simplicity of this process, there must be yet some considerable discoveries to make in the detail, as nothing has been produced in this country, which can, in respect of execution, be compared to the works produced on the Continent.*

It is obvious, that supposing the impression produced, is equally fit to answer the purpose required, the whole expense of engraving may be saved, as the artist may himself, at once, make the design on the stone; besides this, the stone is in no wise worn by printing, and any number of prints may be taken with it. Nothing resembling the tone, or effect of the fine productions of line engraving, can be produced; but an inspection of any of the works before noticed will shew that it is admirably adapted to represent subjects of natural history, outlines, designs, plans, &c. The art is also applicable to the multiplication of writings, as the subject required to be printed, may be written on the prepared paper before noticed, and transferred on the stone, and printed without the least delay, and at no other expense than the mere printing. At Munich, where this art is principally practised, all the proclamations, &c. relating to the State, are thus printed.

We have just learnt, that Mr. Ackerman of the Strand, has procured a person from Munich, who perfectly understands the mode of printing from stone: and that, in a short time, Mr. A. means to print in this manner for the public.

Art. IX. *Journal of a Voyage up the River Missouri, performed in* 1811. *By* H. B. Brackenbridge, Esq. *Author of Views in Louisiana. Second Edition.* Baltimore, 1816.

On the annexation of Louisiana to the United States, an expedition was, in May 1804, sent, under the direction of

* All the prints in the work of Spix, on Craniology, and the Bavarian Flóra, printed at Munich, (both in the library of Sir Joseph Banks) are impressions taken from drawings on stone, and which are proofs of the perfection which can be attained in this

Captains Lewis and Clarke, with directions, after exploring the Missouri, from its conflux with the Mississippi, to its sources, to proceed across the mountains to the first navigable river on the west side which they should be able to follow to the ocean. This was accomplished, after a journey of 3000 miles up the Missouri, to its source, struggling against the stream of that impetuous river, and after an arduous journey over the stony mountains which form the line of partition between the waters of the Atlantic and Pacific Ocean. The passage up the river, occupied from the 18th of August to the 7th of October, when they embarked again on one of the branches leading to the Columbia, and on the 7th of November, first got sight of the Pacific.

Before this expedition of Lewis and Clarke, none were found adventurous enough to penetrate, more than a few hundred miles, that extensive portion of the Continent, passed through by the Missouri. After the return of those celebrated travellers, several Indian traders were induced to extend the sphere of their enterprise, and one of them, Manuel Lisa, ascended the Missouri almost to its source. These enterprising individuals meeting with considerable success, the Missouri Fur Company was formed. The Company engaged about two hundred and fifty men, Canadians and Americans; the first for the purpose of navigating the boats, the latter as hunters. In the spring of 1802, they ascended the Missouri in barges, and left trading establishments in the Sioux country, also among the Arikaras and Mandans. After this, they proceeded with the main body to the three forks of the Missouri, about three thousand miles from its source. The country about the sources of the Missouri, forms a part of the tract wandered over by a nation of Indians, called the *Blackfeet*, á savage race, who have conceived the most deadly hatred to the Americans, partly owing to an unfortunate rencontre between one of the natives and Captain Lewis, who killed one of them by a shot from his rifle. It was not long after the establishment

art. Mr. White, of Brownlow-street, Holborn, print-seller, also has a large work of prints from original drawings, published at Munich, executed on stone.

of the Company, and their building a fort, before the Black-feet commenced hostilities; and at length the party was reduced to about sixty persons, by the detachments left at the different trading establishments below, and by persons sent off with such furs as had been collected; added to this, about twenty had fallen in the different skirmishes with the Indians. Mr. Henry, one of the chief members of the Company, finding his situation extremely precarious, crossed the rocky mountains, and established himself on one of the branches of the Columbia, where he remained until the spring of 1811, the period at which Mr. Brackenbridge ascended the Missouri.

It being at this period a prevailing opinion that the affairs of the company were nearly ruined, in the spring of 1811, they determined to make one more effort, and if possible retrieve their losses and to carry relief to their distressed companions and bring them home, Mr. Henry and his party not having been heard of for more than a year. Manuel Lisa, a Spaniard, was chosen to undertake this arduous task. A barge of twenty tons was fitted out with merchandize to the amount of a few thousand dollars. Mr. Brackenbridge was tempted to join this expedition. The party set off from the village of St. Charles, on Tuesday, the 2nd of April, 1811. The flood of March, which immediately succeeds the breaking up of the ice, was still high. The barge was the best that ever ascended the river, and manned with twenty stout oars-men. M. Lisa had been a sea-captain: the party in the whole consisted of twenty five persons. The equipage was chiefly composed of young men, several of whom had made a voyage to the upper Missouri. They were completely prepared for defence: these precautions being deemed necessary from the hostility of the Sioux bands, who had committed several murders and robberies on the whites: Mr. Wilson P. Hunt had set off with a large party twenty three days before, on his way to the Columbia, and they hoped to overtake him before he entered the Sioux nation; in order to join company in passing through the haunts of these wandering nations.

Lisa's party had on board a Frenchman named Charboneau, with his wife, an Indian woman of the Snake nation, both of

whom had accompanied Captains Lewis and Clarke to the Pacific, and were of great service. The woman was of a mild and gentle disposition, greatly attached to the whites, whose manners and dress she tried to imitate, but had become sickly, and longed to revisit her native country; her husband also, who had spent many years amongst the Indians, had become weary of a civilized life.

The party exerted themselves to the utmost, anxiously wishing to overtake Mr. Hunt. On the 23rd, about noon, they espied at some distance before them on a sand bar, a number of persons, whom they at first took to be Indians, but on a nearer approach recognised to be whites. On coming to the spot, they found it was one of the Missouri company's factor at the Mandan village, who was descending with five men, in a small batteau, loaded with peltry. From him they learnt that with the exception of the Mandans, Arikaras, and one or two small tribes, all the nations of the Missouri were inimical to the whites, and that the Sioux had fired on them as they passed; and they also learnt that Mr. Henry was then over the mountains, in a distressed situation, and that he had sent word of his intention to return to the Mandan village in the spring, with his whole party. Sunday the 20th of June, after incredible toil in struggling against the rapid currents, Lisa's barge joined Hunt's party; they had fortunately in the night passed all the Sioux bands, who had been seen by Hunt, but probably found his party too strong to attack.

Mr. Nuttall, a gentleman known in this country by the number of curious vegetables which he has contributed to our collections, and a Mr. Bradbury, a naturalist, accompanied the party of Mr. Hunt, who was also joined by two persons of the name of Crook and M'Clelland, adventurous hunters, who had wintered on the banks of the Missouri. On the 26th of June they reached the fort of the Missouri company above the Mandan villages, 1640 miles from the mouth of the Missouri. They had now reached the utmost point of their voyage, for though it had been at first intended to proceed to the cataracts of the Missouri, for the purpose of attempting a treaty with the black-foot Indians, the information received from Mr. Henry

had produced a change in Lisa's intentions. He resolved to wait for him at this place, or at the Arikara village; and in the mean while, arrange the affairs of the company.

Mr. Hunt determined to purchase some horses at Arikara, and proceed by land to the Columbia, being assured by some hunters this would be the best route.

Mr. Brackenbridge being tired of this wandering life, returned with two boats loaded with skins to Port Louis, which had been dispatched by Lisa; he commenced his journey on the last day of July, and arrived in August, having performed 1440 miles in 14 days.

We have received considerable pleasure in the perusal of the journal of Mr. Brackenbridge; it is written in an unaffected style, and the appearance of the wonderful country through which the party passed is well described. Mr. Brakenbridge has no pretensions to science, "the voyage," he observes, "was undertaken by me in the spirit of adventure which characterises so many of my countrymen." We extract the following description of the return of a party of Indians from battle as a fair specimen of his style.

"In the mean while a stilly suspense reigned throughout the village, all sports and business were suspended, and it resembled a holiday in one of our towns. We at length perceived the warriors advancing by the sound of their voices over a hill, about a mile below our encampment. In a short time they made their appearance; at the same time, the inhabitants of the town moved out on foot to meet them. I accompanied them for some distance, and then took a favourable position where I might have a full view of this singular scene. They advanced in regular procession, with a slow step and solemn music, extending nearly a quarter of a mile in length, and separated in platoons, ten or twelve a breast, the horsemen placed between them, which contributed to extend their line. The different bands of which I have spoken, the Buffalo, the Bear, the Pheasant, the Dog, marched in separate bodies, each carrying their ensigns, which consisted of a large spear, or bow, richly ornamented with painted feathers, beads, and porcupine quills. The warriors were dressed in a variety of ways, some with their cincture and crown of feathers, bearing their war clubs, guns, bows and arrows, and painted shields: every platoon having its musicians, while the whole joined in the song and step together, with great precision. In each band there were scalps, fastened to long poles: this was nothing more than the few scalps they had taken, divided into different locks of hair, so as to give the semblance of a greater number. The appearance of the whole, their music, and the voices of

so many persons, had a pleasing and martial effect. The scene which took place, when their friends and relations from the village, mingled with them, was affecting. These, approached with song and solemn dance, as the warriors proceeded slowly through their ranks: it was a meeting of persons connected by the most tender relations. Fathers, mothers, wives, brothers, sisters, caressing each other without interrupting for a moment, the regularity and order of the procession, or the solemnity of the song and step! I was particularly touched with the tenderness of a woman who met her son, a youth wounded, but who exerted himself to keep on his horse, and from his countenance one might have supposed nothing had been the matter with him. She threw her arms round him and wept aloud. Notwithstanding the young man expired, shortly after being brought to the medicine lodge; for it is the custom to carry such as have been wounded in battle, to be taken care of in this place, at the public expense. As they drew near the village, the old people who could barely walk, withered by extreme age, came out like feeble grasshoppers, singing their shrill songs, and rubbing the warriors with their hands. The day was spent in festivity by the village in general, and in grief by those who had lost their relatives. We saw a number of solitary females, on the points of the hills round the village, lamenting in mournful wailings, the misfortunes which had befallen them. For the two succeeding days the village exhibited a scene of festivity; all their painted shields and trophies, were raised on high poles near the lodges, and all the inhabitants dressed out in their finery; all their labours and sports were suspended, and the whole joined in the public demonstrations of joy, while music, songs, and dances were hardly intermitted for a moment.

About the latter end of October Lisa arrived at St. Louis; Mr. Henry had joined him at the Arikara village, having passed the mountains early in the spring, and having encountered incredible sufferings and dangers. Lisa had left trading establishments with the Sioux below the Cedar island, as well as with the Mandans and Arikaras. This immense tract of country has now become the theatre of American enterprise; there prevails amongst the natives west of the mountains, a spirit of wild adventure; the American hunters constituting a class different from any people known, to the east of the mountains; the life they lead is exceedingly fascinating, the scene ever changing, and confined by no regular pursuit, their labour is amusement.

We add to our account of Mr. Brackenbridge's Journal, a short statement of the fate of Mr. Hunt's party, in their journey from the banks of the Missouri to the Columbia,

together with the account of the return of Messrs. Crooks and M'Clellan, from the Company's settlements on the Pacific to the Massouri.

Mr. Hunt and his party having purchased 80 horses, departed from the Arikaras, on the 18th July, sixty persons in number, and 86 horses. In this situation they proceeded for five days, having crossed in that time two considerable streams, which joined the Missouri below the Arikaras, when, finding an inland tribe of Indians, they procured from them an addition of forty horses. Steering about W. S. W they passed the small branches of Big River, the Little Missouri above its forks, and several tributary streams of Powder River, one of which they followed up; they found a band of the Absaroka nation encamped on its banks, at the foot of the Big Horn Mountain.

For ammunition and some small articles, they exchanged all their lame for sound horses, with these savages. The distance from the Arikaras to this mountain is about four hundred and fifty miles, over an extremely rugged tract, by no means furnishing a sufficient supply of water; but during the twenty-eight days they were getting to the base of the mountain, they were only in a few instances without abundance of buffalo meat.

Three days took them over the plains of Mad River, which they followed for a number of days, and then left it where it was reduced to eighty yards in width, and the same evening reached the banks of the Colorado or Spanish River. Finding herds of buffalos, at the end of the third day's travel on this stream, the party passed a week in drying buffalo meat for the remainder of the voyage, as, in all probability, those were the last animals of the kind they would meet with. From this camp, in one day, they crossed the dividing mountain, and pitched their tents on Hoback's Fork of Mad River; and, in eight days more, having passed several stupendous ridges, they encamped in the vicinity of the establishment made by Mr. Henry, in the fall of 1810, having travelled from the main Missouri, about nine hundred miles in fifty-four days.

Here, abandoning their horses, the party constructed

canoes, and descended the Snake River, (made by the junction of Mad River, south of Henry's Fork,) four hundred miles, in the course of which they were obliged to make a number of portages, till at length they found the river confined between gloomy precipices, (at least two hundred feet perpendicular,) whose banks, for the most part, were washed by this turbulent stream, which, for thirty miles, was a continual succession of falls, cascades, and rapids. From the repeated losses by the upsetting of canoes, their stock of provisions was reduced to a bare sufficiency for five days; totally ignorant of the country where they were, and unsuccessful in meeting any of the natives from whom they could hope for information.

Unable to proceed by water, Messrs. M'Kenzie, M'Clelland, and Reed, set out in different directions down the river, for the purpose of finding Indians, and buying horses. Mr. Crooks, with a few men, returned to Henry's Fork for those they had left, while Mr. Hunt remained with the main body of the men, entrapping beaver for their support. Mr. Crooks finding the distance much greater by land than he had contemplated, returned at the end of three days, and after waiting five more, expecting relief from below, the near approach of winter made them determine to deposit all superfluous articles, and proceed on foot. Accordingly, on the 10th of November, Messrs. Hunt and Crooks set out, each with eighteen men, on different sides of the river.

Mr. Hunt was fortunate in finding Indians with abundance of salmon, and some horses, but Mr. Crooks saw but few, and in general, too poor to afford his party assistance; thirty days journey brought the latter to a high range of mountains, through which the river forced a passage, and the banks being their only guide, they still, by climbing over points of rocky ridges, projecting into the stream, kept as near it as possible, till, in the evening of the 3d of December, impassable precipices of immense height, put an end to all hopes of following the margin of this water course, now no more than forty yards wide, and which ran with incredible velocity, and was withal, so foamingly tumultuous, that even had the opposite bank been fit for their purpose, all attempt at rafting was

impracticable, from the rapidity of the stream. They endeavoured to climb the mountains, still bent on pushing on, but after ascending for half a-day, they discovered, to their regret, that they were not half way to the summit, and the snow already too deep for men in their exhausted state to proceed.

Regaining the river bank, they returned, and, on the third day, met with Mr. Hunt's party, with one horse, proceeding downwards; a canoe was soon made, of a horse hide, and in it was transported some meat, which they could spare, to Mr. Crooks's starving followers, who, for the first eighteen days after leaving the place of deposit, had subsisted on half a meal in twenty-four hours; and, in the last nine days, had eaten only one beaver, a dog, a few wild cherries, and old moccasin soles, (having travelled during these twenty-seven days, at least five hundred and fifty miles.) For the next four days, both parties continued up the river, without any other support than such rose-buds and cherries they could find; but here they fell in with some Snake Indians, from whom they got five horses, in exchange. From hence Mr. Hunt went on to a camp of Shoshonies, about ninety miles above, where, procuring a few horses and a guide, he set out across the mountains to the south west, for the main Columbia, leaving on the banks of the river, Mr. Crooks and five men, unable to travel.

Mr. Hunt lost a Canadian, named Carrier, by starvation, before he met the Shy-eye-to-ga Indians, in the Columbia plains; from whom he got a supply of provisions, and soon reached the main river, which he descended in canoes, and arrived without any farther loss, at Astoria, the principal settlement of the Fur Company in the Columbia, in the month of February.

Messrs. M'Kenzie, M'Clelland, and Reed, had united their parties on the Snake River Mountains, through which they travelled twenty-one days, to the Mulpot River, subsisting on an allowance by no means adequate to their toils; here they found some wild horses; and soon after reached the forks called by Captains Lewis and Clark, Koolkooske; went down

Lewis's River and the Columbia, wholly by water, without any misfortune except the upsetting of one of the canoes in a rapid, and reached Astoria early in January.

Three of the five men who remained with Mr. Crooks, fearing to perish by want, left him in February, on a small river, on the road by which Mr. Hunt had passed, in quest of Indians, and had not been heard of. Mr. Crooks had followed Mr. Hunt's track in the snow for seven days, but coming to a low prairie, he lost every appearance of a trace, and was compelled to pass the remaining part of the winter in mountains, subsisting sometimes on beaver and horse meat, and their skins, and at others, on roots. Finally, on the last of March, the only remaining Canadian being unable to proceed, was left with a lodge of Shoshonies, and Mr. Crooks, with John Day, finding the snow sufficiently diminished, undertook, from Indian information, to cross the last ridge, which they happily effected, and reached the banks of the Columbia in the middle of April: and, on the 10th of May, they arrived safe at Astoria.

On the 28th of June 1812, Mr. Robert Stuart, one of the partners of the Pacific Fur Company, with two Frenchmen, and Mr. Ramsey Crooks and Robert M'Clelland, left the Pacific Ocean for New York.

After ascending the Columbia upwards of six hundred miles, they happily met with Mr. Joseph Miller, on his way to the mouth of the Columbia; he had been considerably to the south and east, among the nations called Blackarms and Asapahays, by the latter of which he was robbed; in consequence of which, he suffered almost every privation human nature is capable of, and was in a state of starvation and almost nudity when the party met him.

They pursued their journey with fifteen horses, for the Atlantic states, without any uncommon accident, until within about two hundred miles of the Rocky Mountains, where they unfortunately met with a party of the Crow Indians, who behaved with the most unbounded insolence, and were

solely prevented from cutting off their party, by observing them well armed. They, however, pursued them on their track six days, and finally stole every horse belonging to them.

All the party were now on foot, and had a journey of two thousand miles before them, fifteen hundred of which was entirely unknown, as they intended to prosecute it considerably south of Messrs. Lewis and Clark's route ; and it was, of course, impossible to carry any quantity of provisions on their backs, in addition to their ammunition and bedding.

The danger to be apprehended from starvation was imminent. They, however, courageously pursued their route towards the Rocky Mountains, at the head waters of the Colorado, or Spanish River, and steered their course E. S.E. until they struck the head waters of the great River Plate, which they undeviatingly followed to its mouth. This river, for about two hundred miles, is navigable by barges ; from thence to the Otto Village, within forty-five miles of its entrance into the Missouri, it is a mere bed of sand, without water sufficient to float a skin canoe.

From the Otto Village to St. Louis, the party performed their voyage in a canoe, furnished them by the natives.

After they had crossed the Rocky Mountains, they fell in with a small party of Snake Indians, from whom they purchased a horse, which relieved them from any further carriage of food. They wintered on the River Plate, six hundred miles from its mouth. From the account of this party, it seems, that a journey across the continent of North America, might be performed with a waggon, there being no obstruction in the whole route that any person would call a mountain.

ART. X. *On the Genus* CRINUM. *By* JOHN BELLENDEN KER, *Esq.*

PROPOSING to review in succession the genera which we have enumerated in the article on AMARYLLIS (Art. XIII. of No. IV. in the Second Volume of this Journal), as composing the second section of Jussieu's NARCISSI; to avoid repetition, we shall refer throughout our reviews to that place, for the ordinal and sectional relations of all the genera. The generic and specific attributes will form alone the subject of the future articles.

The vegetable group included under CRINUM consists of species of peculiar stateliness, and of a stature in proportion more generally gigantic than in any other with a tunicated bulb. We are not aware of a corolla within the genus, much below the height of half a foot when fully extended. The species are remarkable for the apparent sameness of configuration which pervades the whole of them; and it is no slender evidence of the botanical acuteness of the late Dr. Roxburgh, that he has seized and embodied in description the faint and wavering marks which distinguish essentially likenesses so near. Nor should it be forgot, that to his assiduity, while superintending the public garden at Calcutta, we owe the discovery of nearly two parts in three of those now recorded.

It has been intended by some to transfer the section of AMARYLLIS, with a multifarous foliage and bulbispermous capsule, to CRINUM. In our opinion, this would be to complicate the character of the latter, without simplifying that of the former; and to reject the most ready technical characteristic which marks the boundary between them, for no corresponding advantage. Why should not the genera connect where they now do, as well as where they would then? A bulbispermous capsule is not peculiar to the multifarious leaved long-tubed division; it occurs in that distinguished by a bifarious foliage, and a nearly tubeless flower; and is possibly in neither a constant character.

The type of the genus, as now restricted by definition, has not been observed to range beyond the tropical or nearly tropical regions. The East Indies has the largest proportion of

species. None have been noticed at the Cape of Good Hope or the neighbouring parts, where, however, the liliaceous type is more general and diversified than in any other part of the globe. AMARYLLIS *longifolia* seems the closest transition-species in that quarter.

The colour of the flowers is confined to white and various modifications of red. The bulb is sometimes elongated cylindrically, so as to have the appearance of a stem; nearly as it is in the common leek, but on a larger scale. A characteristic we have never observed in AMARYLLIS.

GENUS.

CRINUM. *Umbella* pluri-numerosiflora, bracteis numero pedunculorum distincta, longior *spathâ* bivalvi. *Corolla* supera, erecta, tubuloso-sexfida; *tubus* strictus, pluriès longior germine, non ampliatus in faucem; *limbus* sexpartitus subæqualis, regularis, radiatus. *Filamenta* in summo tubo, uno versu inclinata v. divergentia sexfariàm, *antheræ* lineares, vibratæ. *Stylus* inclinatus, exsertus tubo, modò æqualis flori: *stigma* simplex obtusum, rariùs obsoletè trina: *germen* 3-loculare, polyspermum, ovulis in loculamento singulo biseriatis. *Capsula* membranosa, tenuis vel coriaceo-crassa, oblato-sphærica, trilocularis, sæpè loculo uno vel et altero abortivis: *semina* numerosa, horizontalia, cumulata, margini interno septi utrinque annexa, anguloso-compressa, submarginata, vel sæpiùs pauca tuberoso-laxata, vel unicum: *albumen* sicco-carnosum durum, vel sæpiùs ad instar tuberis tumifactum mollius atque succosius.

Genus transeuns in AMARYLLIDEM *ad ejusdem species longè tubulosas cum foliis multifariis, à quibus dignoscitur solâ regularitate limbi rotati.* HÆMANTHO *accedit ad ejusdem* multiflorum. Bulbus *sæpè porraceus vel productus in collum concentricè foliosum caudiciforme ferè ac in* ALLIO PORRO. Folia *multifaria, latè vel angustè lorata, canaliculata vel planiora.* Flores *candicantes aut variè purpurascentes; semipedales ad pedales et ultrà.*

I. *Umbellâ sessili vel subsessili.*

1. *americanum.* C. foliis striatis; umbella sessili pauci-pluriflora: tubo sulcato sublongiore limbo; laciniis lanceolatis planiusculis, undulatis; staminibus inclinatis.

Crinum americanum. *Linn. sp. pl. ed.* 2. 1. 419. *L'Heritier sert. angl.* 8. *Hort. Kew.* 1. 413. *ed.* 2. 2. 221. *Willd. sp. pl.* 2. 46. *Curtis's magaz.* 1034.

Crinum Commelini. *Redouté liliac. t.* 322; (*nec Jacquini*).

Lilio-Asphodelus americanus sempervirens minor albus. *Commel. rar.* 15. *t.* 15.

Folia lato-lorata, lanceolata. *Flores* albi: *limbo* infernè conniventi, laciniis latitudine semunciam excedentibus. *Filamenta* uno versu declinato-assurgentia, purpurea. *Stylus* purpureus, æquans stamina: *stigma* punctum simplex.

Patria: America Meridionalis.

2. *erubescens.* C. foliis lanceolato-loratis, cartilagineo-denticulatis; umbella subsessili pluriflora; tubo longiore limbo; staminibus sexfariis stylo parùm brevioribus.

Crinum erubescens. *Hort. Kew.* 1. 413. *ed.* 2. 2. 221. *Willd. sp. pl* 2. 46. *Curtis's magaz.* 1232. *Jacq. hort. schoenb.* 4. *t.* 30. *Redouté liliac.* 27.

Crinum foliis carinatis. *Miller ic.* 73. *t.* 110.

Bulbus ovatus, magnitudine pugni. *Folia* lanceolato-lorata, canaliculata supernè plana, 3-pedalia, latitudine biunciali. *Scapus* compressus, bipedalis, purpurascens. *Umbella* 6-7-flora. *Flores* odoratissimi. *Tubus* corollæ purpureo-virens, sesuncialis v. circitèr: *limbi laciniæ* 4-unciales, intùs albicans extùs longitudinalitèr secùs medium roseo-purpurascentes, lanceolato-lineares, planiusculæ, reflexo-patentes. *Filamenta* sanguineo-purpureâ: *antheræ* flavæ. *Stylus* sanguineus, filamentis paulò longior.

Patria: America Meridionalis.

Obs. Vix hujus loci Crinum *erubescens: nov. gen. et spec. orb. nov. a Kunth?* **Huic bulbus squamosus, folia integerrima, flores**

10-pollicares, tubo 7-pollicari, laciniis 2½ pollices longis. Species ex sicco descripta, ulteriùs in vivo recognoscenda ut sortiatur locus. Crescit propè Turbaco et los Volcanitos in humidis Regni Novi Granatensis.

Commelini. C. corollarum apicibus introrsùm uncinatis; foliis linearibus canaliculatis, scapo subquadrifloro. *Jacquin hort. schoenb.* 2. 40. *t.* 202.

Bulbus magnitudine juglandis, ovatus, fuscus, stoloniferus. *Folia* plura, sublinearia ad oras integerrima, plùs minùs pedalia, canaliculata, tereti-concava, suprà plana, apice cartilagineo obtusula, erectiuscula, 8 lineas lata. *Scapus* brevior foliis, compressus, calamum crassus, purpurascens. *Spatha* rubescens, ferè triuncialis. *Flores* sessiles, sæpiùs tres, suaveolentes, erecti, albi. *Corollæ tubus* cylindricus, a quatuor ad sex uncias longus: *laciniæ limbi* lineari-lanceolatæ, acutæ, planæ, tubo duplo breviores, ad apicem rubellæ, dorso fasciam longitudinalem mediam purpuream gerentes, primò patentes, indè reflexæ. *Filamenta* uno versù inclinata purpurea: *antheræ* flavæ. *Stylus* purpureus brevior vel longior staminibus. *Jacquin.*

Patria: America Meridionalis.

defixum. C. bulbo oblongo-globoso rhizomate fusiformi, humo altè demisso; foliis rigentèr erectis, angustè loratis, canaliculatis, longè acuminatis, margine glabro; umbella subsessili, multiflora, capsulis pedunculatis; stylo æquali staminibus.

Crinum asiaticum. *Roxburgh corom. inedit. Musæo Banks. cum tab. pict.*

Belutta-pola-taly. *Rheede hort. malab.* 11. 75. *t.* 38. *Rudb. elys.* 2. *t.* 90; *(figura Rheedii.) Synonymon aliàs minùs rectè* asiatico *datum.*

Bulbus non in collum v. caudicem porraceum productus, rhizomate stolonifero deorsùm perpendiculari-fusiformi, humi altè defixo. *Folia* multifaria, involuta, semicylindraceo-concava, ecarinata, longitudine unius vel duorum

pedum, latitudine ¾ partium unciæ v. parùm ultrà. *Scapus* sæpiùs brevior foliis, frequentiùs coloratus. *Umbella* 6—12-flora. *Flores* magni, albi, noctu odori: *tubus* cylindricus, longitudine 4—6-unciali, è parte solari coloratus, ex alterâ pallidè virens: *laciniæ* lineari-lanceolatæ, margine subundulatæ, universæ apice recurvo-appendiculatæ. *Filamenta* æqualitèr incurvo-patentia, dimidio superiori colorata: *anth.* incumbentes. *Stylus* inclinatus: *stigma* simplex. *Capsula* de germine subsessili longiùs pedunculata, membranosa, subglobosa, loculis mono-dispermis: *semina* bulbosa, rugosa. *Ex angl. Roxb.*

Patria: India; in paludosis vel limosis ad fluviorum ripas.

5. *ensifolium.* C. bulbo ovato; foliis sparsis rectis uniformibus.

Nondùm floridum in horto botanico Calcutta. *Defixo* proximum, at differt formâ bulbi, foliis minùs canaliculatis, longinquiùs attenuatis, cum acumine plurimùm argutiori atque longiore. *Roxburgh corom. inedit. Musæo Banks.*

Patria: Pegu.

6. *amoenum.* C. bulbo sphærico; foliis lorato-attenuatis margine subglabro; umbella pauci-(6)-flora, sessili, laciniis lineari-lanceolatis tubo subæqualibus.

Crinum amoenum. *Roxburgh MSS. in the Library of the East India Company: cum tab. pict.*

Gocinda. *Incolis.*

Species minor elegans. *Bulbus* mediæ magnitudinis circumferentiâ 8—12-unciarum, penè globosus, neque porraceo-caudescens v. in stipitem continuatus. *Folia* 6—12, multifaria, recta, plùs minùs canaliculata præcipuè versùs basin, margine obsoletiùs scabrata, 1—2-pedalia latitudine sesquiunciali. *Scapus* lateralis, solitarius, pedalis, teres. *Umbellæ* 4—8-floræ, bracteatæ. *Flores* magni, albi, sessiles: *tubus* 3—4-uncialis, trigonus: *laciniæ* lineari-lanceolatæ, acutæ. *Filamenta* assurgenter inclinata, subæquantia limbum, purpurascentia: *anth.*

lineares. *Stylus* staminibus sublongior, incurvatus, filamentorum concolor : *stigmata* 3 : *germen* oblongum, lævigatum ; polyspermum.

Patria : India Orientalis ; Silhet.

7. *sumatranum.* C. bulbo ovali non caudescente ; foliis lato-loratis, lineari-lanceolatis, rectis, canaliculatis, margine albo-cartilagineo scabris, rigidis : umbella multiflora subsessili.

Crinum sumatranum. *Roxb. corom. ined. Museo Banksiano.*

Bulbus radiculas crassè carnosas exserens. *Folia* erecta, lato-subulata, 3—6-pedalia, 3—6-uncias lata, obversa lumini inspecta clathrato-nervosa, concava, rigentia, margine albido calloso hispido, acumine obtusiusculo. *Scapus* axillaris, brevior foliis. *Flores* magni, albi, sub-pedecillati, 10—20 : *tubus* cylindricus, quadriuncialis ; *laciniæ* limbi lineares, tubo æquales. *Filamenta* ascendentia, colorata, limbo breviora. *Stylus* brevior staminibus : *germen* tubi subisoperimetrum. *Capsula* magnitudine pugni : *semina* magna bulbosa, 2—3. *Ex angl. Roxb. vers.*

Patria : Sumatra, interioribus. Horto botanico Calcutta cultum.

8. *longifolium.* C. bulbo sphærico ; foliis lorato-attenuatis, laxiùs effusis, canaliculatis, margine hispido ; umbella subsessili multiflora ; laciniis lineari-lanceolatis subbrevioribus tubo.

Crinum longifolium. *Roxburgh corom. inedit. Musæo Banks.*

Congeneri *deflexo* præ cæteris accedens ; at diversum facie, magnitudine, et formâ bulbi. Est multò majus, bulbo globoso cui rhizoma non fusiforme neque limo altè demersum. *Folia* plurima, multifariàm recumbentia, ab ipsa basi sensìm attenuata cum puncto acuto, 2—3-pedalia finibus emarcidis, concava, ecarinata, margine cartilagineo scabriusculo, striata, ubi latiora

2 uncias transversa. *Scapus* axillaris, subcompressus, longitudine varians, inundatis flores attollens extra aquam, siccis brevior foliis. *Umbella* 8—12-flora; *flores* magni, albi, fragrantes, intra 2 valvas *spathæ bracteis* filiformibus distincti. *Tubus* subcylindricus, intùs rugosus, 4-uncialis v. circitèr. *Filamenta* ascendentia, colorata, limbo fermè æqualia: *antheræ* fuscæ, incumbentes. *Stylus* æquans stamina, coloratus: *stigmata* 3, parva. *Germen* oblongum, triloculare, *ovulis* 8—16. *Capsula* diametro uni-biunciali, torosa: *semina* 1—8, magnitudine pro ratione numeri variantia.

Patria: in herbidis atque inundatis depressis Bengalæ interioris solitariò proveniens.

9. *cruentum.* C. bulbo ovato-pyramidato, stolonifero; foliis lato-subulatis, margine scabriusculo; spatha herbacea elongato-oblonga apice rotundata: laciniis plus duplo longioribus tubo.

Crinum cruentum. *nobis in Botanical Register fol.* 171; *cum icone.*

Bulbus externè livido-purpureus, sobolibus repens. *Folia* atrovirentia, coriaceo-crassa, multifaria, infrà ex collo productiùs vaginantia, recumbentia, longiora quadripedalia, 4 uncias cum dimidio lata, obsoletè scabrata. *Scapus* (nunc duo successivi) compressus vel anceps aciebus rotundatis, viridis. *Spatha* erectiuscula, foliaceo-virens, valvâ majore semipedali. *Umbella* sessilis, uno versu subinclinata, pluri-(7)-flora, *bracteis* angustis distincta. *Flores* ex tubo ad emarcescentiam usque longitudine excrescentes, ut denuò in extensum undenas uncias pedemve exæquant, stricti, subodorati, roseo-purpurei, senescentes albo-maculosi. *Germen* viride, cylindrico-oblongum, obsoletè trigonum, estriatum, exsulcum, vix tubo continuo corollæ crassius. *Tubus* strictus, in longioribus septemuncialis vel ultrà, calamum crassus, pallido-virens, tereti-trigonus, exsulcus, estriatus: *limbus* recurvo-stellatus, laciniis elongato-lanceolatis, subtriuncialibus latitudine unius tertiæ partis unciæ,

exterioribus medio dorso virentibus, interioribus sublatioribus. *Filamenta* sanguinea, unâ quartâ parte breviora limbo vel circitèr, gracilia, divaricata : *antheræ* lineares, in lunulam curvandæ, vibratæ, luteæ. *Stylus* vix filamentis crassior, æqualis flori, intensè puniceus, triquetro-filiformis : *stigma* punctum atrosanguineum parùm incrassatum.

Patria : India orientalis?

10. *angustifolium*. C. foliis margine scabris, germinibus subsessilibus, staminibus laciniis lanceolatis stylove ¼ brevioribus, filamentis antherâ 5—6-ies longioribus. *Brown prod. nov. holland.* 1. 297.

Haud aliàs notum nobis.

Patria : Nova Hollandia intra tropicum.

11. *venosum*. C. foliis — ? germinibus subsessilibus, tubo laciniis elliptico-lanceolatis venosis duplo longiore, staminibus limbi dimidio brevioribus, antheris filamenta æquantibus, stylo incluso. *Brown loc. cit.*

Non aliàs notum nobis.

Patria : Nova Hollandia intra tropicum.

12. *moluccanum*. C. bulbo sphærico, non in collum producto ; spatha 4—6-flora ; floribus sessilibus, declinatis, tubo recurvato æquali laciniis lanceolatis : foliis linearibus undulatis reclinatis margine scabro.

Species elegans è minoribus. An potiùs Amaryllidis species ?

Patria : Amboyna. Horto botanico Calcutta 1798 *allatum.* Ex angl. Roxb. *corom.* ined. in Mus. Banks.

II. *Umbellâ pedunculatâ.*

13. *asiaticum*. C. bulbo porraceo-cylindrico, toto extante ; foliis lanceolatis margine lævi, longioribus scapo, umbella numerosa pedunculata : laciniis angustis linearibus reflexis, vix longioribus tubo.

Crinum asiaticum. *Lin. sp. pl. ed.* 2. 1. 419. *L'Heritier sert. angl.* 8. *Hort. Kew. ed.* 2. 2. 45. *Curtis's magaz.* 1073. *Willd. sp. pl.* 2. 45. (*exclusis passìm Rheede, Burman, et Miller.*)

Crinum americanum. *Redouté liliac.* 332.

Crinum toxicarium. *Roxburgh corom. inedit. Mus. Banks. cum tab. pict.*

Mun-shu-lan.—Crinum.—*Drawings of Plants done at Macao in China*, 1808, *by Wan-tchun, a Chinese painter. In the library of the E. I. Company. The Catalogue by William Kerr.*

Bulbine asiatica. *Gærtner sem.* 1. 42. *t.* 13?

Lilio-Asphodelus americanus sempervirens maximus polyanthus albus. *Commel. rar. tab.* 14. *Dillen. eltham.* 194. *t.* 161. *fig.* 195.

Lilium zeylanicum bulbiferum et umbelliferum. *Herman. lugdb.* 682. *t.* 683.

Radix toxicaria. *Rumph. amboin.* 6. 155. *t.* 69.

Bulbus magnus in collum longum caudiciforme productus. *Folia* plurima, multifariàm patentia, 3—4-pedalia latitudine 5—7-unciali, costâ mediâ crassâ, subtùs pallidiùs striata. *Scapus* lateralis, pollicem crassus. *Spatha* sphacelata, obtusa, reflexa. *Umbella* interdùm 60-flora, hemisphærica; *floribus* candidissimis, vix semipedalibus, remissè odoris; *laciniis* infernè brevè subconniventibus, indè stellatis, revolutis, involuto-canaliculatis, subtriuncialibus, æqualibus, acutulis. *Filamenta* erecto-patentia, supernè purpurea, $\frac{1}{3}$ parte breviora limbo *v.* magìs: *antheræ* obliquè incumbentes. *Stylus* gracilis, supernè rubens, æqualis vel longior staminibus: *stigma* minutum, simplex, triquetro-obtusum, obsoletè pubescens: *germen* 3-loculare, virens, oblongum, polyspermum, *pedunculo* brevi. *Capsula* parte persistente tubi præfixa, unilocularis, loculamentis 2 abortivis: vix tamen constanter?

Patria: China; in sabulosis litoreis insularum adjacentium Macao. W: Kerr MSS. in Library of the E. I. Comp.

14. *lorifolium.* C. bulbo cylindraceo-ovato; foliis loratis an-

gustis longissimis lentis, margine vix scabris; umbella multi-(20)-flora, pedunculata.

Crinum lorifolium. *Roxburgh corom. inedit. Museo Banksiano.*

Folia enormitèr elongata, debilia, flexa, basi ubi latiora vix duas uncias lata, in longitudinem quinquepedalem vel majorem porrigenda. *Ex angl. Roxb.*

Patria: Pegu. Horto Botanico Calcutta cultum.

15. *amabile.* C. bulbo maximo porraceo-pyramidato, extante: foliis numerosis, lato-subulatis glauciusculis, margine lævi; umbella numerosa pedunculata; tubo subbreviore limbo.

Crinum amabile. *Donn hort. cant. ed.* 6. 83. *Nobis in Curtis's magaz.* 1605. *tabb. A. et B.*

Crinum superbum. *Roxburgh corom. inedit. Mus. Banks.*

Liliacearum princeps. *Bulbus* indusiis innumeris membranaceis corticatus; in plantâ modò septenni pedalis ad sesquipedalem crassitudine cruris. *Folia* infrà vaginantia indè multifariàm divaricata, 3—6-pedalia latitudine 3—6-unciali. *Scapus* lateralis, inclinatus, brevior foliis. *Spatha* magna, acuminata, valvis reflexis; *bracteis* linearibus. *Umbella* sub-30-flora; *floribus* maximis, roseo-purpurascentibus, fragrantissimis. *Germen* coloratum ovali-oblongum, rotundatum, læve, exsulcum, *pedunculo* ipsi longiorè crasso tereti-trigono. *Tubus* obsoletè trigonus saturatè coloratus, quinqueuncialis v. ultrà, rotundatè trigonus. *Limbus* revoluto-stellatus; *laciniis* elongato-lanceolatis, $\frac{3}{4}$ partes unciæ latis v. magis, tubo æqualibus v. sublongioribus, extùs saturatiùs coloratis, intùs roseo-albicantibus. *Filamenta* atro-purpurea, ferè duplo breviora limbo, incurvo-patentia, gracilia: *antheræ* atro-sanguineæ, unciales v. longitudine dimidii filamenti, vibratæ, versatiles. *Stylus* staminum concolor, longior, inclinatus: *stigma* parvulum subapertum, obtusum, puberulum.

Patria: Sumatra.

. *bracteatum.* C. bulbo subcolumnari, foliis oblongo-lanceolatis obtusè acuminatis cum puncto cartilagineo, margine lævissimis, subundulatis; umbella multiflora pedunculata pallido-bracteosa; limbo tubo sublongiore; stylo breviore staminibus. *Nobis in Botanical Register* 3. 179. *cum tab.*

Crinum bracteatum. *Willd. sp. pl.* 2. 47. *Jacq. hort. schoenb.* 4. 7. *t.* 495.

Crinum brevifolium. *Roxburgh MSS. cum tab. in the Library of the East India Company.*

Crinum asiaticum. *Redouté liliac.* 348.

Bulbus magnus ovato cylindraceus 4—5-uncialis, non verò porraceus vel productus in collum, radiculis crassis. *Folia* plurima, multifaria, patentia, uni-sesquipedalia, uncias 3—5 lata, utrinque striata, exteriora sæpiùs cartilagine tenui albâ integerrimâ abeunte in cuspidem callosam marginata, deorsùm brevitèr angustata atque erecta. *Scapus* octouncialis ad pedalem, valdè compressus, intùs planior, extùs convexior. *Umbella* 10—20-flora, conspicuè distincta *bracteis* pallidis lanceolatis tubum subsuperantibus. *Spatha* 3-uncialis. *Flores* magni, albi, odori, brevè pedunculati, uncias quinque in extensum superantes: *tubus* rectus, teretiusculus, obsoletè trigonus, calamum crassus; *laciniæ limbi* recurvo-stellatæ, lanceolato-lineares, subæquales, æquantes vel subexcedentes tubum, *exteriores* tertiam partem unciæ latæ, canaliculato-concavæ, *interiores* planiores angustiores. *Filamenta* regulari-divergentia, ex tertiâ parte vel magìs breviora limbo, suprà sanguineo-rubentia: *antheræ* vibrato-incumbentes, flectendæ. *Stylus* brevior staminibus, sanguineus: *stigma* punctum viride obsoletè trilobulatum: *germen* breve, oblongum.

Patria: Insula Mauritii. Horto Botanico Calcutta cultum.

17. *canaliculatum.* C. bulbo cylindraceo, parùm caudescente; foliis loratis, canaliculatis, attenuatis, margine lævi; umbella numerosiflora, longè pedunculata; laciniis linearibus obtusis, longioribus tubo.

Crinum canaliculatum. *Roxburgh MSS. in the library of the East India Company; cum. tab. pict.*

Folia 8—14, multifaria, lorata, propè finem attenuata, 3—5-pedalia, latitudine 3—4-unciali. *Scapus* axillaris, unicus, bipedalis, duplo brevior foliis, pollicem crassus *Umbella* 30—50-flora; *floribus* niveis, mediæ magnitudinis, fragrantes, *pedunculis* longis *bracteis* interstinctis. *Tubus* semicylindricus, 2 uncias cum dimidio longus; *laciniæ* canaliculatæ recurvæ. *Filamenta* inclinato-assurgentia, dimidio limbi pauld longiora, supernè colorata. *Stylus* triqueter, staminibus æqualis: *stigmata* 3, minuta, lobiformia: *germen* triloculare, *ovulis* biseriatis pluribus. *Ex anglico Roxb.*

Patria ignota. Primùm 1806 *horto botanico Calcutta comparuit.*

18. *pedunculatum.* C. bulbo porraceo-cylindrico; scapo centrali lato-compresso; umbella multiflora, laxa, pedunculata; limbo breviore tubo, stylo staminibus sexfariis breviore.

Crinum pedunculatum. *Brown prod. fl. nov. holl.* 1. 297. *Nobis in Botanical Register v.* 1. *fol.* 52; *cum icone.*

Crinum taitense. *Redouté liliac.* 408.

Crinum australe. *Donn cant. ed.* 6. 83.

Bulbus porraceo-caudescens, glaberrimus, diametro brachii vel triplo crassior. *Folia* plurima, multifaria, lato-lorata, lanceolata, margine lævi. *Flores* plurimi, albidi, *pedunculis* crassis germine cylindrico virente longioribus. *Tubus* 4-uncialis, cylindricus, ochroleucus: *laciniæ* firmulæ, recurvo-stellatæ, lineares, angustæ, obtusissimæ cum apiculo acuto. *Filamenta* supernè sanguinea, sexfariàm patentia: *antheræ luteæ. Stylus* sanguineus, non longè exsertus tubo.

Patria. Nova Hollandia, apud Portum Jackson.

19. *augustum.* C. bulbo columnari, extante; foliis multifariis lanceolatis canaliculatis margine lævi; scapo longitudine foliorum; umbella pedunculata, 20—30-flora, floribus (limbo?) declinatis.

Ex ornatissimis sectionis ordinis suæ. *Scapus* tripedalis, atropurpurascens, crassitudine carpi infantis. *Flores* roseo-rubentes, suaveolentes: *pedunculi* uni-biunciales: *tubus* dilutiùs purpurascens, 4—5-uncialis: *laciniæ limbi* lineares, semipedales: *filamenta* et *stigma* purpurea. *Ex angl. Roxb. corom. ined. Musæo Banks.* An potiùs Amaryllidis congener?

Patria: Insula Mauritii.

Addendum Diss. de Amaryllide; *suprà vol. 2. No. IV. Art. XIII.*

Amaryllis *latifolia. Vide suprà vol. 2. page 369. n. 45.*

Crinum *latifolium. Roxburgh corom. ined. in Musæo Banks.*

Diù pro varietate Amaryllidis *zeylanicæ* habuimus, at inspecto bulbo differre reperimus; illo loco maximè quidèm, at aliquatenùs quoque ex aliis.

Simillima Amaryllidi *giganteæ. Bulbus* sphæricus circumferentiâ bipedali, basi depressior quàm apice: in *zeylanicâ* ovalis. *Folia* numerosa, multifaria, lanceolata, undulata, attenuata de propè basin in acumen latiusculum obtusiusculum, margine denticulatìm scabro, 1—3-pedalia latitudine 3—5 unciarum: in *zeylanicâ* plurimùm angustiora, costâ mediâ valdè prominentiore, bipedalia, insigniùs undulata, margine lævi. *Spatha* 10—12-flora, ovato-lanceolata, intùs multibracteata. *Flores* magni, sessiles, remissè odori: *tubus* viridis; *limbus* albus, tinctus rubore dilutissimo roseo: in *zeylanicâ* color longè intensior. *Tubus* declinatus, cylindricus, obsoletè trigonus, 4-uncialis *Limbus* campanulatus, horizontalis; laciniis lanceolatis 3—4-uncialibus, apice molli subulato. *Filamenta* subbreviora limbo: *antheræ* ex luteo cinerascentes: hæcce in *zeylanicâ* fuscæ. *Stigmata* 3. *Capsula* bulbisperma. *Ex angl. Roxb.*

Patria: Bengala.

NOTA.

Crinum urceolatum. *Flora peruviana* 3. 58. *tab.* 287.
Non hujus loci. In genus novum separandum? Dignoscendum floribus dependentibus, limbo urceolato-campanulato, staminibus exsertis, capsula trigona trisulca. Fortè congener HÆMANTHUS *dubius; nov. gen. et spec. orb. nov. à Kunth?* Is certè ab HÆMANTHO depellendus; et, quantùm ex descriptione dijudicare liceat, prædicto CRINO anomalo non sine jure genericè approximandus.

ART. XI. *On a new Species of Resin from India. By* J. F. DANIELL, *Esq. F. R. S. M. R. I.*

THE resinous substance, the properties of which I shall endeavour to describe, was sent to me for examination by my friend Mr. H. B. Ker. Its history is this.—A lady brought from India a work-box that had been varnished: the varnish looked particularly clear, and had borne the heat of the climate without cracking or changing colour. Some distinguished artists saw it, and admired its peculiar beauty. The lady sent to the Rajah from whom she had originally procured it, and he remitted her an hamper full of stone bottles, containing the varnish, informing her that it was employed in all his ornamental work, and that it was used just as it was extracted from the tree from which it was procured, by incision. The name of the tree he unfortunately omitted to send. Its original consistence is that of cream, and when spread upon white paper, it dries quickly, is colourless, and of a brilliant polish, never cracking when exposed to the sun. The specimens which were sent over were put into the bottles upon being collected, and the precaution was taken of filling their necks with water. Notwithstanding this, their contents had become perfectly solid. In the state in which I received it

the resin was opake, except just at the exterior coat, which was slightly translucent, of a very pale green colour, conchoidal fracture, and of a lustre intermediate between resin and wax. It was tasteless, easily pulverized, and inodorous. It inflamed with violence, and deposited much carbonaceous matter whilst burning, and diffused a pleasant aromatic smell. Its specific gravity was 1033.

Two hundred grains of it pulverized were boiled for three hours in half a pint of distilled water: it was then allowed to stand for twelve hours. The resin, on being collected and dried, had lost in weight only 0.8 of a grain. The infusion was reduced by evaporation, and it then presented the following properties. Muriate of tin threw down a dark brown powder; solution of chlorine in water produced a yellow precipitate; and muriate of alumina, when boiled with it, became cloudy. These are the indications of extractive matter.

It was then subjected to the action of cold alcohol. Much of it was dissolved, but an insoluble white powder remained, and did not decrease in quantity by boiling.

The same white substance was left when the resin was acted upon by ether and spirits of turpentine. It was collected upon a filter well washed with alcohol, dried at a gentle heat, and then weighed 75 grains.

The alcoholic solution was colourless, and had a very peculiar smell, resembling that of the bruised stalks of green vegetables: water instantly precipitated the resin. It was evaporated at a very gentle heat, and a light yellow transparent resin remained, which weighed 127 grains. The same resin was collected from the etherial solution.

The undissolved residue was inflammable and burned with much smoke and a pleasant smell. It possessed no elasticity to the touch, but felt like powdered starch. It was not affected by any temperature under 360° of Fahrenheit's scale, when it began to fuse; and melted by a continuation of the heat into a deep-brown transparent resin. The resin which had been dissolved by alcohol began to soften at 100°, and the original resin at 220°. The specific gravity of the most fusible was 932; of the least fusible 1000.

From these experiments it appeared probable, that the peculiar good properties of this resin, as a varnish, arose from the resistance of the latter ingredient to the action of heat and chemical menstrua, and that in nature the most fusible resin was the solvent of the least fusible. I was the more anxious to find out some means of again combining the two in the fluid state, as I had little doubt but that the compound might prove an useful acquisition to the arts.

Acetic acid acted upon the resin in the same way as spirits of wine, turpentine, and ether: it dissolved one portion and left the other. Fifty grains of the natural resin and of the two separate resins were boiled in nitric acid. The action upon the most fusible was very violent. Nitrous gas was given off, and it was first converted into a deep orange-coloured substance, and then dissolved. The other two required longer digestion and a stronger acid, but were finally dissolved, after having been converted to a deep orange colour. Water added to the solutions produced a yellow precipitate, very bitter to the taste, and inflammable. Lime water produced no change, proving that no oxalic acid had been formed; but acetate of lead threw down a copious precipitate of malate of lead. It is remarkable, that the nitric solution, upon standing for some days, emitted a very strong smell of apples. It produced a slight cloud in solution of isinglass.

Solutions of the alkalies dissolved the most fusible resin copiously, the least fusible sparingly. They were precipitated by muriatic acid, and re-dissolved by excess.

Olive oil combined with the natural resin; but the compound was opake. When previously melted, it united with linseed oil, forming a drying varnish, but of a deep yellow colour. When subjected to distillation, a thick oil came over, possessing a strong empyreumatic odour. It was taken up by alcohol, from which it was again precipitated by the affusion of water. A small quantity of carbon was left in the retort.

From these experiments it appears, that the least fusible

resin approaches in its characters to copal, differing, however, from it, in being insoluble in ether.

After many fruitless trials, I at length succeeded in effecting the solution of the resins, either combined or separate, by the following process. Equal parts of camphorated spirits of wine and oil of turpentine were put into a flask, and about an eighth part of ammonia added to them. The resin was then put in, n fine powder, and the whole boiled together. The turpentine does not unite with the spirits of wine; but from the agitation of boiling, they become intimately blended, and thus mixed, they act upon the resin and dissolve it completely. The addition of ammonia to either spirits of wine or turpentine separately, is not sufficient for this purpose. Upon being allowed to stand at rest for some time, the liquid separates into two portions. The lower is transparent and brown, the upper opake; but in the course of a few days likewise becomes clear, and is nearly devoid of colour. It has a slight tinge of green, and when spread upon white paper, it quickly dries, and forms a remarkably tough and glossy varnish. Its specific gravity shews that it is chiefly composed of the spirits of wine; it retains, however, a strong smell of the turpentine.

Very little of the resin is left in solution in the lower stratum of liquid, but nearly all the camphor; and when poured upon paper, it evaporates, leaving it behind in white powder, without any stain.

The mean of three analyses of the natural resin, one made by ether, and the other two by alcohol, gives the following result:

Extractive matter soluble in water	-	0.4
Resin soluble in alcohol and ether	-	62.6
Resin insoluble in alcohol and ether	-	37.0
		100.0

There can be little doubt but that if this resin can be obtained in sufficient quantity, that it may become a very valuable acquisition to the arts.

Art. XII. *On some Combinations of Platinum. By Mr.* John Thomas Cooper. *Addressed to the Editor.*

SIR,

I beg leave to transmit to you, an account of some new combinations of platinum, which I discovered while engaged in experiments on that metal: should you conceive them of sufficient interest, you will be pleased to afford them a place in your Journal.

I have obtained an alloy of this metal, different from any hitherto recorded; it is a compound of 7 parts platinum, 16 copper, and 1 zinc. The platinum and copper are first fused with the usual precaution of covering the metals with charcoal, and adding a flux of borax. When it is in perfect fusion, it is removed from the fire, the zinc is added, and after stirring the mass, an alloy will be formed, having the colour, malleability, and nearly the ductility of alloyed gold of 16 carats fine: so striking is its resemblance to that precious metal, that it might, with equal facility, be employed for the fabrication of articles of utility and ornament, as it never becomes oxidated by exposure to air, under ordinary circumstances, nor is it acted on by nitric acid, unless at a boiling heat.

I have stated this alloy to be eminently ductile and malleable, but it is only so when absolutely free from iron. I have found the presence of $\frac{1}{2}$ a grain of iron in 4oz. of the alloy, has rendered it very brittle, and has consequently impaired both its malleability and ductility.

The pure alloy can be rolled into laminæ, as thin as gold, and I have drawn it into wire $\frac{1}{150}$ of an inch in diameter, and in either of these states it can be dissolved in nitric acid, the specific gravity of which is not less than 1.25.

It has generally been stated, that there exist two oxides of platinum, an opinion with which I am willing to coincide, but I apprehend, that the proportions of oxygen are too highly rated, and that instead of oxides, triple salts, mixed with the oxides, have been obtained.

The two oxides are stated by Chenevix, to contain 7 and 13 oxygen, combined with 100 metal, and by Berzelius, 8.287 and 16.38 oxygen with 100 platinum; but the sequel, I think, shows that the protoxide has never before been obtained in a pure state, and that it consists of 100 platinum, united with only 4.317 oxygen. Indeed, the methods used by Chenevix, must have procured him triple salts. The mode adopted by Berzelius, seems equally liable to objection. He obtained his peroxide by precipitating muriate of platinum by quicksilver; but in such cases, it is extremely difficult to prevent adulteration of mercury in the precipitate; and his method of procuring the protoxide is not less objectionable. He obtains it by exposing muriate of platinum to heat, ascertaining the quantity of chlorine given off, and estimating the quantity of oxygen that in other substances exists in the bases, united to an equal quantity of chlorine.

The protoxide may be obtained by pouring a perfectly neutral solution of mercury into a dilute solution of muriate of platinum, in hot water; a dense powder will precipitate, varying in colour from deep brown to yellow, and sometimes olive green. The powder, which is a compound of calomel and protoxide of platinum, is to be very carefully washed and dried, and then exposed to a heat, not more than sufficient to raise the calomel: that being done, there will remain an intense black powder, which is the protoxide of platinum.

In order to ascertain the proportion of oxygen in this oxide, which has always been much over-rated, I have undertaken a variety of experiments. 100 grains of the powder were heated to intense redness in a bent tube of green bottle glass, furnished with a cap and stop cock, and exhausted of common air. After giving off 12.5 cubic in. of oxygen, which were collected over mercury, the oxide was reduced to the metallic state: on examination, the metal was found to be very slightly coherent, but sufficiently so to enable me to remove it in one piece: it was now weighed, and found to have lost 4.7 grains: on examining the oxygen that had been liberated, it was found to be quite pure, as it required for its saturation, as nearly as possible, twice its volume of pure hydrogen.

100 grains of the oxide, mixed with 30 grains of pure lamp

black, were introduced into a similar tube, with stop cock, &c. which, after exhaustion, was heated as before to redness: the cock was afterwards opened under mercury, and the gas received in a graduated jar: it measured 12.8 cubic in.; and this gas, on being exposed to a solution of caustic potass, was all absorbed, except a residuum of 0.35 cubic in., which possessed all the characters of azote. It is needless to state, that the gas absorbed, was carbonic acid.

The materials in the retort, being taken out and weighed, were found to have lost 6.3 gr: 12.5 cubic in. of carbonic acid were produced, which, reduced to standard temperature, would, according to De Saussure, weigh 5.96, leaving a difference of one-third of a grain, a trifling loss, probably arising from an increased pressure of the atmosphere.

A portion of the oxide, mixed with sulphur, was exposed to heat; sulphurous acid was disengaged, but through accident, the results were not collected.

A curious property of this oxide should here be mentioned. When heated *per se*, or with combustibles, it is easily reduced, but when mixed with enamellers flux, it is capable of sustaining a very intense heat, without decomposition; indeed, it has withstood reduction in the most violent degree of heat I was able to give it. From this property, it will become an article of the greatest importance in the art of enamelling, as all blacks hitherto employed, are compounds of iron, cobalt, or manganese, which only afford a black colour, when used in body, the lighter washes appearing either purple, blue, or brown, as either of these oxides predominate. We can now, however, produce an enamel colour, which preserves an intense black in the lighter shades, and is, moreover, capable of sustaining the most violent fire, without injury, which none of the former colours will bear, without change; and hence I conceive the artist is at length in possession of one of the most important colours, which, among a few others, has long been a desideratum with enamellers. From the success I have hitherto met with, I may indulge in the hope, that my endeavours will enable me to succeed in producing, for the use of the enameller, a complete set of permanent

colours and bases, the want of which has long been felt, and has probably retarded that branch of art from reaching the eminence it is capable of attaining.

There is another very valuable colour, produced by precipitating a neutral solution of platinum, by metallic tin, which is brown, and like the foregoing, is capable of bearing any degree of heat without decomposition. The process is tedious, requiring many days before the whole of the metal is precipitated. The precipitate of platinum, by muriate of tin, may also be employed, but it is neither so bright a colour, nor so dense as that by tin alone.

The black oxide of platinum, which I conceive to be the protoxide, is not soluble in any acid, except the muriatic. By long digestion, with the assistance of heat, it dissolves in this acid without effervescence, and a dark coloured solution is obtained, similar to that produced by the action of nitro-muriatic acid on platinum; its habitudes being precisely those of that salt so obtained. It is capable of crystallizing, and its crystals present a similar aspect to those of the nitro muriatic salt, or muriate of platinum, as it is called: when heated, water, at first, is disengaged, and lastly, considerable quantities of chlorine.

From the foregoing results, we may deduce the weight of an atom of platinum. The protoxide gives off by heat 12.5 cubic in. of oxygen, which, at the temperature of 48°, weigh 4.317 gr., which accords with its loss of weight, excepting a trifling loss of one-third of a grain, which may be attributed to the accidental presence of a minute quantity of moisture: from the result, we calculate.

$$\left.\begin{array}{l} 4.317 : 95.682 \\ 4.517 : 100. \end{array}\right\} :: 1 : 22.164$$

as the equivalent expression of an atom of platinum.

By pouring a neutral solution of tartrate of soda into muriate of platinum, moderately diluted, no action takes place while cold; but if it be heated to about 180° or 200° of Fahrenheit, a decomposition ensues, an instantaneous change of colour is produced, and a blackish powder precipitates. This powder requires considerable washing, with repeated affusions of boiling water

to free it entirely from the acids; if it be now dried, it will appear of a grayish black colour. To determine its composition, it was dried on a sand bath, the temperature of which was 300°. in order to free it entirely from loose water: it was then heated in a tube similar to that employed in the former experiments, but nothing was given off except a small quantity of water too minute to be collected; its amount was estimated by heating 100 grains to redness by which it lost 2,8 grs.; no ascertainable quantity of gas was disengaged, for on opening the stop cock under mercury after the vessel had cooled, the mercury rushed in and filled the tube, with the exception of the remnant that had escaped the air pump. I made other experiments with precisely the same results; all therefore that I could obtain from this substance, was platinum and water, and I consider it as a hydrate of that metal. I have already mentioned the necessity of washing this powder with large quantities of water, and if this be not attended to, both carbonic acid and carburetted hydrogen will be obtained on heating it, from the decomposition of the tartaric acid.

If we consider the equivalent of an atom of platinum to be 22,164, we must conclude the hydrate to be composed of two atoms of platinum and one of water; should it be considered like other hydrates as constituted of one atom of platinum and one of water, then the equivalent expression of the atom of platinum must be doubled, and it will be 44,328.

It possesses the peculiar character of other hydrates: when heated, it undergoes no change until it arrives at the point of ignition, when it suddenly becomes incandescent, and its particles are seen to approximate considerably. This effect is easily shown, by heating a few grains of the hydrate upon a strip of platinum, over a spirit lamp.

I have reduced considerable quantities of this hydrate in crucibles of various kinds, and have always found it to occupy less than one-eighth of the bulk it filled before ignition, even if pressed together with considerable force: after undergoing this process, its particles are so agglutinated, as to resist separation, and when struck by the blows of a hammer, upon a hard surface, it extends considerably before it separates;

by repeated heating and hammering, it may be wrought into a solid bar. This will afford the most ready and easy method of making malleable platinum, an operation allowed to be difficult of execution. I have thus succeeded in reducing it into bars which have undergone the operation of rolling into very fine laminæ, and have also drawn it into wire $\frac{1}{350}$ of an inch in diameter.

I am at present engaged in some other experiments upon this subject, of which I shall send you the results.

Very respectfully yours,

J. T. COOPER.

76, Drury-lane,
March 16th, 1817.

Art. XII. *Botanical Extracts from a Periodical Miscellany published in Spanish at Santa Fé de Bogotá, entitled "El Semanario del Nuevo Reyño de Granada."* 1810.

From some leaves of the above work, which have been just put into our hands, we learn that the long expected history of the genus Cinchona or bark-trees has been completed and published in South America. This was an undertaking of the venerable and laborious Celestino Mutis, and of which his nephew Don Sinforoso Mutis has executed the part which remained unfinished at the decease of his uncle, in 1808. But the more interesting intelligence to the botanist, is, that the great work of the "*Flora bogotensis,*" which formed the principal occupation of the last forty-five years of the active life of the same respectable naturalist, was then (1810) fast advancing towards publication, under the charge of his nephew, the editor of the first. The species to be comprised in it, are calculated at 2000: all native within the circuit of Bogotá. The numerous plates of the figures are announced as executed in the finest manner, under the inspection of the Author. To this are to be appended the descriptions of a collection of

plants formed in the province of Quito, under the direction of Mutis himself. The care of editing the last portion is committed to Don F. Josef de Caldas, an eminent botanist in those parts. While the principal work is arranging and reducing to order in the method of Linnæus; it is proposed to publish occasionally such genera as the editors shall conceive to be new, three or four at a time, in the consecutive Numbers of the Journal now before us.

In a spot so distant and sequestered from the present focus of science, we are not surprised at the regret we find expressed for the want of the more recent works of natural history; with us in the hands of every one, they are there scarcely known by name. This deficiency must naturally abate the confidence of the editors in what relates to the novelty of that which they have to offer. In much they cannot but find themselves forestalled; especially by the works of Messrs. Humboldt and Bonpland.

We shall subjoin the six genera which appear in the leaves now before us; and are the first of the series. We place them as they follow in Linnean order. The technical generic character in Latin; the habit in English.

MONANDRIA MONOGYNIA.

LOZANIA. *Calyx* monophyllus, basi subventricosus, limbo 4-partitus laciniis ovato-acutis patentibus, persistens.

Corolla o. *Nectarium* receptaculaceum 4-angulare, fundum calycis occupans.

Filamentum unicum, parvum, obliquè sub germine insertum, a basi ad apicem sensìm attenuatum. *Anthera* didyma, ovata.

Germen ovatum. *Stigmata* tria, parva, simplicia, subcapitata, capitulo colorato.

Capsula ovata, apice acuminata, trigona, unilocularis, trivalvis. *Semina* sex (tria frequentèr abortiva) geminata, angulosa, fundo capsulæ inserta. *Sinforoso Mutis.*

OBS. Of this genus only one species has been found. A *tree; leaves* alternate, oblong, serrate, sharpened at the end. *Flowers*

spiked, *peduncles* axillary, crowded: *pedicles* from the axils of small linear *bractes*. Found in woody places in the temperate districts of New Granada. The name is in honour of Don George Thaddeus Lozano, a zoologist of eminence in those regions.

PENTANDRIA MONOGYNIA.

POMBEA. *Calyx* monophyllus, superus, 5-fidus laciniis ovatis acutis, persistens.

Corollæ petala 5, obtusa, calyce longiora, decidua.

Filamenta subulata, erecta: *antheræ* oblongæ biloculares.

Germen inferum: *stylus* cylindricus, staminibus pauló longior: *stigma* capitatum, depressum.

Capsula hemisphærica, calyce coronata, bilocularis, bivalvis: *semina* numerosa, minima, oblonga, dissepimento affixa. *Franc. Jos. de Caldas.*

OBS. An only species. A *shrub;* with alternate lanceolate quite entire smooth near-set *leaves*, and *flowers* in simple terminal nodding bunches. Native of the province of Quito. The name is a tribute of gratitude from Caldas to Don Joseph Ignatius Pombo, a munificent and patriotic patron of the sciences in the new kingdom of Granada.

ICOSANDRIA MONOGYNIA.

CONSUEGRIA. *Calyx* monophyllus, coriaceus, 3-gonus, turbinatus, limbo 4-fido plano patente, laciniis lanceolatis intùs glabris extùs tomentosis, persistens.

Filamenta filiformia (12-24) fauci calycis inserta, limbo breviora: *antheræ* subrotundæ biloculares villosæ, *polline* albo.

Germen oblongum: *stylus* filiformis basi villosus, longitudine staminum; *stigma* penicilliforme.

Capsula unilocularis, oblonga, villosa, calyce involuta: *sem* unicum oblongum. *Fran. I. de Caldas.*

OBS. Two species. Both *shrubs. Leaves* ternate, or unequally pinnate: *Flowers* in terminal racemes. In one species the angles of the calyx are prickly, in the other without prickles. In one the stamens are from 20 to 24, in the other from 14 to 16. This name is in honour of Don Sinforoso

Mutis and Consuegra. The latter appellation has been adopted; because that of Mutis had been already applied by Linnæus to a genus dedicated to his uncle Celestino. The Spaniards of distinguished families bear the paternal and maternal names connected by the particle and.

MONADELPHIA DECANDRIA.

AMARIA. *Calyx* monophyllus, tubo cylindrico, basi rotundo, ore 5-fido, laciniis linearibus apice coalitis, latere dehiscens, persistens.

Corollæ petala 5, obovata, æqualia, patentissima, calyci inserta, a basi ad apicem carinata.

Filamenta subulata, erecta, basi in tubum coalita: *antheræ* oblongæ, biloculares, incumbentes.

Germen oblongum, pedicellatum, lateralitèr calyci insertum: *stylus* cylindricus, erectus, longitudine staminum: *Stigma* capitatum.

Legumen longissimum, compressum, apice acuminatum, ad semina torosum, pedicellatum, uniloculare, bivalve, dehiscens: *semina* multa rotunda, compressa. *Sinforoso Mutis.*

OBS. Found in the temperate districts of New Granada. Two species are known. Both *shrubs*; one with cordate petioled *leaves*, the other with cordate sessile, somewhat clasping *leaves*. One with terminal, the other with axillary *flowers*: *peduncle* many flowered. Named after his excellency Anthony Amar y Borbon, the Viceroy, and a liberal patron of Botany, in the furtherance of which he has promoted several extensive expeditions in the interior of his government.

MONŒCIA SYNGENESIA.

CALDASIA. (*Masculini flores fœmineis commixti.*) Capitulum ovatum, scutellis 5-6-gonis, pyramidalibus, pedicellatis, coccineis, deciduis undique tectum.

Calyx proprius polyphyllus laciniis (12-16) linearibus apice dentatis erectis corollâ minoribus, persistens.

Corolla monopetala, hypocrateriformis; tubus cylindricus longitudine calycis; limbus patens 3-fidus laciniis obcordatis.

Filamentum unicum, cylindricum, tubulosum, erectum, exsertum, corollâ duplo longius: *antheræ* 3 in tubum coalitæ, oblongæ, biloculares, longitudinalitèr dehiscentes, *polline* albo.

(*Fæminei flores masculis intermixti.*)

Calyx ut in masculis.

Corolla nulla.

Germen obovatum, compresssum; *style* 2, filiformes; *stigma* obtusum.

Pericarpium nullum: *semen* unicum, minimum, obcordatum. *I. Celestino Mutis.*

Obs. A genus with the habit of Cynomorium. Four species are known; one of which is diœcious. All are leafless with the appearance of Fungi. The name is a compliment to Francis Joseph de Caldas, a celebrated botanist of Santa Fé de Bogotá; from whom a genus has been previously named by Messrs. Humboldt and Bonpland, of which a species is figured in the Botanical Register; so that the present becomes extinct. Amaria, Pombea, and Caldasia are said to include the most beautiful plants of New Granada.

Diœcia Pentandria.

Mas.

Valenzuelia. *Calyx* monophyllus, 5-partitus laciniis patentissimis linearibus acutis.

Corollæ petala 5, ovata, acuta, patentissima, laciniis calycis duplo longiora, et ejus fauci inserta, alterna. *Nectarium* receptaculaceum, pentagonum, coloratum.

Filamenta nectario inserta, corollâ minora; *antheræ* didymæ.

Fæmina.

Calyx ut in flore masculo, sed subtùs villosus, et persistens.

Corolla ut in flore masculo.

Germen rotundum, parvum, bisulcatum: *styli* 2 villosi, revoluti; *stigmata* obtusa.

Nux baccata, oblonga, glabra, quadrilocularis, tetrasperma. *Sinforoso Mutis.*

Obs. As yet an only species. A tree. Native of the temperate parts of New Granada. *Leaves* alternate, ovate, entire, acuminate, unequally pinnate. *Flowers* terminal in corymbose racemes; the *peduncles* and *pedicles* in the male plant villous coloured and bracteate; *bractes* linear, coloured, disposed in whorls. The racemes are sometimes hermaphrodite. Two or three of the seed always miscarry, as in Caryocar. Named after Don Lewis Valenzuela, a disciple of the elder Mutis.

We shall not stop to observe whether the above descriptions are fashioned to the latest models, whether parts which experience has proved important in the characters of vegetables, have been overlooked or too vaguely noticed in them, or not. But we hail with complacency the rays of light now gleaming upon science from the recesses of Southern America. Nor can we receive the efforts of genius newly weaned from ignorance and superstition, with the frowns of a critic. Whatever may be the deficiency in these descriptions, the learning and skill of Mr. Brown has at a glance recognized in Amaria, a congener of Bauhinia; and in Caldasia, a new genus instituted by himself to distinguish others of its congeners of the West Indies from Cymomorium, to which last the celebrated mushroom of Malta belongs. The other genera are probably new, and well founded.

We cannot refrain from noticing the honourable resolve, expressed in the short preface by Mutis and his coadjutor Caldas, on the subject of generic names; "That the laurels of science shall never be bound by their hands round the brow of the undeserving man of power, but be sacredly reserved for the patriot and the sage."

Art. XIII. *Proceedings of the Royal Society of London.*

On Thursday the 5th of December a Paper was communicated by Mr. Tod, containing an account of some experiments on the Torpedo. The author states, that when parts of the

electric organ are removed by the knife, that the animal still enjoys the power of giving shocks with the remainder; and the power of the animal over the organ continues as long as the nerves which supply it remain undivided.

A Letter was also read from Charles Hatchett, Esq. to the President, announcing that the musty flavour of injured wheat might be completely removed by infusing it in thrice its bulk of boiling water, and afterwards washing it in a sufficient quantity of cold water, and drying it in a kiln.

Thursday Dec. 12, Mr. Brande read an account of some experiments on a new species of Galls from China. They are in the form of gray vesicles, and yield 75 per cent. of tan and gallic acid; the remainder being woody fibre with a very small portion of resin. The absence of extractive matter favours the separation of pure gallic acid from these galls, and renders them peculiarly proper for black dyes, the intensity and perfection of which are interfered with by the extractive matter of other substances used in that art: they also furnish an excellent writing ink, but are ill adapted for the purposes of tanning.

Thursday Dec. 19, a Communication upon the subject of Ship-building, by M. Dupin, was read to the Society. The author proves that Mr. Seppings's plan of oblique riders is not new, but has often been resorted to by French ship-builders; and proposes an experiment, which, however, he had not made, to ascertain how far the method alluded to prevents the *hogging* or arching of the vessel. M. Dupin gives Mr. Seppings the credit of having overcome many difficulties in the application of the principle.

On Thursday January 9, the Society resumed their sittings after the Christmas vacation, and a Paper was presented by Sir H. Davy, containing a series of investigations on Flame. The reading of this communication was concluded on Thursday the 16th. The author divided his subject into four branches of discussion. The first relates to the effects of diminished atmospherical pressure upon flame, produced by the air-pump. The second on the influence of rarefaction by heat on the combustibility of gaseous mixtures. The third on the

effects produced by the addition of various gases to explosive aëriform mixtures. The fourth section contained general inferences.

Thursday Jan. 23, another Paper connected with the above subject was furnished by the same chemist.

At the same meeting a Paper was communicated by Dr. Brewster, on the Polarisation of Light.

Thursday Feb. 6, a Paper on Fulminating Platinum, by E. Davy, Esq. was read, and continued on the 13th. The author succeeded in forming a fulminating compound of platinum by the following process: *sulphuret of platinum*, prepared by passing sulphuretted hydrogene through the aqueous solution of muriate of platinum—is converted into *sulphate of platinum* by nitrous acid. To the aqueous solution of this sulphate ammonia is added in slight excess. The precipitate thus formed is boiled in a solution of caustic potash, washed and dried at 212°. It explodes when heated to about 400°, and consists of

Platinum, - -	73,5
Oxygene, - -	8,75
Ammonia and water,	17,50
	100.

Thursday Feb. 20, a Paper was communicated by J. Pond, Esq. Astronomer Royal, on the Parallax of the Fixed Stars. The commencement only of a series of investigations relating to this subject is here detailed.

Thursday Feb. 27, Sir Everard Home presented an account of some Fossil Bones of the Rhinoceros found in a mass of clay in the limestone of Plymouth. No external communication with the cavern that contained them could be discovered. The bones are particularly enumerated and described; and Mr. Brande added some comparative analyses of various fossil bones.

The same evening Mr. Thomas Knight delivered two Papers to the Royal Society; the one "On the Construction of Logarithmic Tables;" the other on "Two General Propositions in the Method of Differences;" which were not calculated for public reading.

Art. XIV. *Proceedings of the Royal Society of Edinburgh.*

January 6th. The Rev. Mr. Alison read the second part of his biographical account of the Life and Writings of the late Alexander Fraser Tytler, Lord Woodhouselee.

January 13th. The annual meeting was held for the election of office bearers. Lord Glenlee was chosen one of the Vice-Presidents in room of the late Lord Meadowbank; and Professor Jameson, Colonel Emrie, Dr. Macknight, and Professor Dunbar, councellors, in room of Walter Scott, Esq. Dr. Jamieson, Dr. Brewster, and Mr. Bryce, who went out by rotation.

January 20th. A Paper was read by Mr. Thomas Lauder Dick on the appearances called the "Parallel Roads" in Glenroy, in the parish of Kilmanivaig, Inverness-shire. Mr. Lauder Dick took an opportunity of examining Glenroy in the course of a pedestrian tour which he made to the West Highlands, along with a party of friends, last autumn. In this essay he describes with great minuteness the appearance of these "roads" or "shelves," (as he is rather disposed to call them) both when viewed at a distance and upon a close inspection. The whole extent of the Glen is about eight or nine miles, extending from north-east to south-west. It consists of six or seven distinct vistas or reaches, into which it is naturally divided by the projections and bendings of the hills which bound it. It is extremely narrow throughout its whole length, and the river Roy runs along the bottom of it. On the sloping surfaces of the hills, on the opposite sides of the valley, the appearances which have been called the "Parallel Roads" present themselves. These are a series of shelves, situated one above the other, which extend throughout the whole Glen. In most parts they are three in number; in some parts only two can be seen; but at one point no fewer than five are distinctly perceptible. From one end of the valley to the other, they preserve the same absolute and relative height, and seem to be perfectly horizontal throughout their whole length. The second road seems to be about thirty yards lower than the first or highest, and the third about sixty yards lower than the second. In number, height, and horizon-

tality, they correspond precisely with each other on the opposite sides of the valley; and this corespondence is preserved round all the bendings, projections, and hollows of the hills They are various in their depth or breadth at different parts; and are evidently much modified by the nature of the ground. Where the hill forms an acute or rounded promontory, or where it is composed of comparatively soft materials, the shelves are always deep; in a harder soil, their indentation is less; and on the surface of rock, the eye can merely trace them, and that is all. At their deeper and more distinct parts their outer edge may be observed to be considerably rounded off, while they are connected, interiorly, to the acclivity above them, by a highly sloping talus. Their surface inclines outwards in a slope of about one foot in five; and is almost every where covered with immense blocks of stone, some of them many tons in weight, lying for the most part quite detached on the surface. At the broadest part their surface did not seem to exceed twenty yards.

Mr. Lauder Dick rejects the hypothesis entertained by some, that these singular shelves are the work of man; and embraces the opinion that they have been produced by the action of the surface of a vast lake, which at some former period had filled the whole valley; but which had undergone a series of successive subsidences from the bursting out of its waters, corresponding to the number of "roads" now visible. He has even discovered a point in the Glen, through which he conceives the waters may have rushed out when the lake subsided from the level of the first to that of the second "road." He supports this theory by a number of observations made on the margins of deep Highland lakes; and also by a perfectly analogous instance of a horizontal road or shelf which surrounds a valley a little above the town of Subiaco, forty-six miles eastward from Rome; which valley is known to have been at one time filled with water. The ruins of the baths of Nero, and the remains of the mouth of the aqueduct by which Appius Claudius conveyed water into Rome, are still to be seen on this horizontal road, which now appears high up on the face of the hills bounding the valley on each side.

Mr. Lauder Dick's description is illustrated by sketches and a plan.

Jan. 27th. The following Gentlemen were elected Members of the Society.

The Right Hon. Earl of Wemyss and March.
The Right Hon. the Lord Advocate of Scotland.
Mr. Baron Clerk Rattray.
Lord Reston.
Dr. Francis Buchanan, F. R. S. and F. A. S.
Dr. David Hosack, F. R. S. Lond. F. L. S. and Professor of the Theory and Practice of Physic in the University of the State of New York.
John Wilson, Esq. Advocate.
John Fleming, Esq. late President of the Medical Board of Calcutta.
Dr. David James Hamilton Dickson.
James Skene, Esq. of Rubislaw.
Dr. William Pultney Alison.
Dr. John Howell.
Rev. Robert Morehead.
Robert Bald, Esq. Civil Engineer.
Thomas Sivright, Esq. of Meggetland.

Feb. 3d. A paper by Dr. Brewster was read containing an account of experiments made by himself and Dr. Gordon on the human eye. These experiments, which were made upon a very recent eye, related principally to the refractive power of the aqueous, vitreous, and crystalline humours, and to the polarising structure of the different parts of the organ. The aqueous and vitreous humours were found, contrary to the received opinion, to have refractive powers perceptibly greater than that of water, the refractive power of the vitreous humour being the highest. The crystalline lens exhibited a polarising structure exactly the same as quartz, or one set of doubly refracting crystals, or the same as the middle coats of the crystalline lens in fishes (see Philosophical Transactions of London for 1816, p. 311.) The iris had the very same structure, but the cornea had an opposite structure, nearly the same as that of calcareous spar, or the same as the outer and inner coats of the crystalline lens in fishes. The tint polarised by the human crystalline was a faint blue of the first order.

At the same meeting the Rev. Dr. Brewster read a paper written by Dr. Craigie on the affinity between the Persian and the Greek and Latin languages.

Sir George Mackenzie read an extract of a letter from Thomas Allan, Esq. containing a sketch of the mineralogical structure of the country round Nice. It is composed almost wholly of limestone, the strata of which are disposed in the most irregular manner. They enclose shells of the same description with those which are found in the sea beneath.

Feb. 17th. Sir George Mackenzie read the first part of an essay on the theory of association in matters of taste. He began by stating that he felt no degree of diffidence in entering on a subject of this kind with views of it considerably different from those entertained by the many eminent writers who had preceded him; and that though his observations were necessarily in a crude state, from his having had but a short time to bestow on committing his ideas to paper, he submitted them as they were, that the Society might not meet without something to discuss, and because nothing ever had been offered to its notice to fill up the vacant hour of this meeting. He therefore trusted to the indulgence of the Society.

The dissatisfaction which we have very generally expressed with all theories of taste, was attributed by Sir George Mackenzie to the circumstance of every investigator having considered only known individual emotions as they happened to be excited by the objects of his inquiry; and from his having set them up as a standard to which the feelings of the whole human race were to be referred. Much ingenuity and talent had been bestowed in the attempts to define the words Beauty and Sublimity; and apparently without success: and this Sir George believed to be owing to the general notion that these terms mean something *sui generis*, and which he considered to be an erroneous notion. He entered on the consideration of the nature of those emotions which have been attributed to beauty and its opposite; and considered them as all reducible into the two *modes*, pleasure and pain. Of these modes, he considered there were various degrees, and that Beautiful denoted a degree of the mode Pleasure, and Ugly a degree of the mode Pain: that Beautiful was to be

classed with such words as handsome, pretty, elegant, lovely, &c. each of which denoted a different degree of the same sort of pleasure; and each seemed to be as much in want of definition and as well entitled to the honour of a theory as the term Beauty.

Sir George then proceeded to point out the great extent to which the abuse of the term Beauty had been carried in ordinary language; and gave it, as his opinion, that philosophers, in appealing so frequently as they have done, to common discourse for proofs of their doctrines, had done what was unworthy of their genius. As some confusion had appeared to have arisen, on account of the want of a proper distinction between natural and artificial language, Sir George entered into a detail explanatory of what he conceived to be the proper distinction. All those gestures, modifications of the countenance, and intonations of the voice, which we use in expressing passion and feeling; joy, sorrow, respect, veneration, &c. and which are intelligible to the whole human race, and, in many cases to the lower animals, Sir George considered as, properly speaking, natural language. This, however, must be distinguished from pantomime or mimicry, which is only the *imitation* of the expression which our nature compels us to use for certain feelings and emotions.

Sir George next proceeded to consider the illustration of the theory of association, as laid down by Mr. Alison, and supported by Mr. Jeffrey, in the article Beauty, in the Supplement to the Encyclopædia Britannica, recently published. He announced his present object to be, an attempt to show that form, colour, and sound, of themselves, without any aid from imagination, and independently of any association, are capable of affecting, by exciting emotions of pleasure or of pain in every degree, those of beauty and ugliness included. He admitted, that associations often added a relish to the pleasureable, or an aggravation to the painful, emotions which external objects are capable of rousing. But as painful associations are often connected with objects that are positively beautiful, and pleasing associations with such as are positively ugly, he considered the pleasure and the pain arising from association to be quite distinct and separate from

the primary and natural effects of form, colour, and sound. This primary and simple effect, he conceived to be of itself sufficient to account for the highest as well as the lowest degree of pleasurable emotion, and for all the degrees of emotion that is painful, without any complication from the effects of association, which he placed on a footing with systems of artificial memory.

From the whole tenor of the principles of the theory of association, it was evident, as would be seen in the consideration of the illustrations, that it supposed us in possession of the power of creating and of destroying beauty whenever our humour might prompt us; a supposition which appeared, primâ facie, unphilosophical, because it embraced what was impossible. Sir George did not consider what he intended to submit to the Society as sufficient to demonstrate his general views of the subject, as this would require much longer time than he had yet had in his power to bestow on the inquiry.

Sir George now followed Mr. Alison in many of his illustrations, and turned them against the theory; and offered several new examples in opposition to the conclusions of that ingenious and eloquent writer. The illustrations this evening were confined to *form*, and were intended to show, that form, considered by itself, without association, was capable of exciting emotions of sublimity and beauty; and examples were also given to prove, that where the associations which were most obvious and natural, ought to have made us admire particular forms, they failed to produce this effect; and that there was also a failure in the opposite way. As the examples were pretty numerous, it is difficult to select any particular ones, so as to do justice to the views of the author. We shall give, however, one or two.

With respect to instruments of war, their form are said to be sublime, on account of their being associated in our minds with danger or power. The generic associations, in the general ideas of the horrors of war, of defeat, or of victory, cannot have any effect in settling our opinions of the *forms* of particular instruments; and we can only suppose that the specific purposes of each particular instrument can affect our

decision as to beauty or deformity. It was of the *form*, not the *appearance*, of such things, that Sir George meant to speak. A cannon, mounted on its carriage, is an object more admired, on account of its form, than a mortar; yet the latter, by association, should be entitled to the preference. For the cannon makes a breach in a stone wall, or in a column of men: but the mortar hurls destruction among the innocent inhabitants of a city, and sweeps all before it, sex and age being undistinguished. The sight of any instrument of war is delightful to a victorious general, but excites very different emotions in a general who has been continually beaten: but notwithstanding this opposition of associations, they both agree in thinking the form of a cannon more elegant than that of a carronade.

The association connected with trees, in order to give them a sublime effect, is said to be their expression of duration and strength. But there is no such expression in the weeping birch, which fixes its roots in the cleft of a precipice, and with which scenery of the most sublime description may be associated. Such scenery is seldom connected with the oak, which is seen in its greatest perfection in parks; yet the oak is preferred to the birch. Ships of war are very commonly associated with the oak, which may be supposed to owe to that circumstance, the admiration which its *form* inspires. But without masts, yards, and bowsprit of pine, the hull of oak could not be carried into battle. The pine is of real importance to her, and is equally entitled to the associations we usually apply to the oak; but its form derives nothing from them. That the form of the oak produces its effect without any aid from association, seems demonstrated by the fact, that out of a great many trees, all of vigorous growth, of the same age, and all equally expressive of duration and strength, one may be selected as the most worthy of admiration, and may be chosen for a picture.

There is nothing in the form of a pen calculated to excite emotions of sublimity, and no one ever thought of ascribing sublimity to such a form. Yet many obvious and impressive associations may be connected with a pen. In this instru-

ment, Bacon found the means of instructing us in the genuine method of pursuing science; and Shakespeare of rousing to their utmost pitch every emotion of which the mind is capable; yet this confers nothing on the form of a pen; nor can we consider it as a disagreeable object, because it has been used to disseminate nonsense and mischief.

March 3*d*. At this meeting, Sir George Mackenzie continued his observations on the theory of association in matters of taste. He began by considering the effects of magnitude; and, by pointing out the error that had been committed, in giving magnitude as a quality to *form*, when it was evident that form is a quality of magnitude, and that magnitude cannot alter form. With regard to the assertion, that animal forms are sublime on account of their being associated with ideas of proportionable power and strength, it was shewn, that this could not be; since, on the slightest observation, we must discover that there is no proportion between the size of animals and their strength. If the muscular power of a flea were to be increased in the ratio of size, and given to all animals, man excepted, the human species would lose all control, and be soon extinguished. No associations can induce us to admire the forms of the elephant and whale. The associations of his cowardice and cruelty, cannot divest the tiger of his beauty; nor can his bravery make us admire the form of the wolf. So far from timidity in animals depriving their forms of the power of exciting the most pleasing emotions, that very circumstance adds to the impressiveness of the form of the stag and other animals.

Sir George now pointed out and illustrated, that there was a determinate magnitude which every living creature possessed, which, when it was increased, became monstrous, and if diminished, it was dwarfish and contemptible; that there was a determinate magnitude to which every inanimate object must reach, in order to be capable of rousing emotions of sublimity, in the first instance; and that there was also a determinate magnitude which was *most* sublime. He showed that the assertion, that magnitude in height expressed mag-

nanimity, was erroneous, since it could only have been derived from poetical comparison, which was not association any more than metaphor. Sir George had no objection to a magnanimous person being compared to a church steeple, but because such a comparison had been made, he could not feel that a church steeple expressed magnanimity. Magnitude in length could not, as had been said, express vastness, because this last term implied other dimensions as well as length; and the illustrations used by Mr. Alison, of a *plain* and the *ocean*, were inapplicable from this circumstance. Magnitude in breadth is said to express stability. We know that there is a law which governs matter, by which we are instructed to give a broad base to whatever we wish to stand firm. But such knowledge is no more the result of association, than natural language, or any thing which nature has taught us. Magnitude in depth is said to express terror; and Mr. Alison appeals to the popular notion of hell being a deep abyss. But we do not think of hell, when we stand upon a high rock, and look down upon a rich valley beneath us; and here there is magnitude of depth. Sir George took an opportunity to impress on the Society, that *fear* has no share in the emotions called sublime. Sublimity is lost when fear takes possession of us, and when fear departs, sublimity is restored. He spoke of his own emotions when he visited the Icelandic Geyser, which may be considered as a cauldron connected with hell by association. The true emotion of sublimity prompted him to explore every thing about this wonderful fountain; but had fear operated, he would have kept at a distance. He observed, that it was perhaps erroneous to speak of magnitude as a quality of height, depth, breadth, and length; because all these together composed magnitude, and it appeared improper to speak of the *whole* of a thing as a quality of a *part* of the *same* thing.

Sir George endeavoured to show, that description ought not to be appealed to for proof in any case where taste is concerned; because just notions of *form* can only be acquired by sight or touch. The experience of every one who visits a

country of which he had previously read a description, demonstrates that the real scenery is quite new to him when he beholds it ; and it is the same with every thing.

That *curvilinear* forms derive their beauty solely from their expression of tenderness and delicacy, was contradicted by an appeal to a snake, in which, besides the absence of these qualities, associations occurred of a very disagreeable kind ; yet the curves of a snake were universally esteemed beautiful. The example, also, of a ship under sail, which is a form universally admired, was produced to show the presence of curvilinear forms without tenderness and delicacy ; also, the example of the outline of a mountain scene ; a winding path up a hill ; and the forms of bridges.

Mr. Alison acknowledges, and endeavours to prove, that trees are sublime, from their expression of duration and strength ; and he deprives them of beauty because they express the same thing, the absence of delicacy and tenderness. The very circumstance of the twisting and curving of the branches, is generally considered as the cause of our admiring trees, and some more than others, on account of their having such forms. In this instance, Mr. Alison distinctly separates beauty and sublimity ; and it is somewhat singular, that his able and distinguished supporter, Mr. Jeffrey, should clearly show, that one of the consequences of Mr. Alison's theory is, the identification of sublimity, beauty, and the picturesque.

With respect to imitations, Mr. Alison asserts, that they may be so perfect as to deceive us into a belief that they are real : but that whenever we are told that an object we admire is an imitation, in iron or any other metal, the beauty instantly vanishes before the conviction of the force and labour employed in producing the imitation. Sir George Mackenzie stated, that from this, it followed, that imitations must recede from, or approach to, beauty, in proportion to the rigidity of the material employed, which was impossible. On such principles, it appeared necessary, that the beauty of a statue should vanish before the conviction of the long time and labour employed on the hard material of marble. It is quite inconsistent to refuse excellence of workmanship, which is

the apology for Mr. Alison's admiring a statue, any effect in the imitation of other things in hard materials, which, he says, are such as to deceive us into a belief of reality, which a statue can never impress. Mr. Alison also asserts, that a bar of iron, twisted into the most perfect spiral form, is beautiful, but that the conviction of the force and labour employed, destroys the beauty of the form. Yet, he says, that this same bar of iron reduced, by a far greater amount of force and labour, to the state of fine wire, restores beauty. But according to his own principles, the more delicate the wire, the more should the expression of delicacy be obliterated, by the conviction of the increasing force and labour employed.

March 17*th*. Sir George Mackenzie continued his observations on the theory of association. He stated that after this evening, he would not occupy the attention of the Society any longer, during the present session, with the subject of taste; and that he hoped to submit his ideas in a better shape than that in which he had offered them; and also what he proposed to substitute for the existing theories of taste, to the deliberate attention of philosophers, at some future time. He then proceeded to offer some remarks on architectural objects, with the view to show that forms of this kind produce their full effect on the mind at once, without a moment being allowed for reflection, or for commencing any train of thought in search of associations. No one, he observed, ever thought of ascribing beauty to the exterior of a building which was plain and irregular, and without any particular arrangement, although the interior might be exceedingly commodious, and richly furnished: nor of ascribing ugliness to the elevation of a Grecian structure, the interior of which presented neither convenience nor splendid decoration. It would be absurd to say that on entering a city we were not at liberty to admire the elevations of the houses, without troubling the inhabitants with unseasonable visits, in order to show our devotion to the minute associations, which were supposed to be necessary to constitute beauty. He appealed to the individuals who first invented any style of architecture, and challenged the advocates of association to show that this individual, when he invented what we so much admire, constructed the forms out of

any impulse but that of his own innate faculties. He felt certain proportions and dimensions to be better calculated to excite emotions of pleasure than all others: to him they were irresistible, and he reduced them to practice; and to us any alteration gives offence from the same cause, not from any fanciful associations.

The beauty of the human countenance had been attributed to the expressions of youth and health; of innocence, gaiety, sensibility, intelligence, delicacy, and vivacity. To this Sir George replied, that this implied as much as if we could not tell whether a woman was young and healthy, unless her face was beautiful; which is absurd. He said it was presumptuous to appropriate all these qualities exclusively to beautiful women, when we know that they were all in equal possession of homely females. Vice, according to the principles of the theory, ought to *destroy* female beauty, in the same manner as the idea of force and labour was said to destroy the beauty of an imitation of any thing. But vice, the most disagreeable association that could be attached to a female, never altered our opinion of beauty. The goddess of beauty herself is described as a strumpet and adulteress; yet we look upon her statue, said Sir George, as a model of perfection in the female form. Pretty idiots, he observed, were more common than ugly ones; and female geniuses have been known, whose faces no man could consider beautiful. Such associations as those to which, it had been said, that the female countenance owed its beauty, were therefore impossible, or at best fanciful; unless beautiful women were the patentees of youth, health, innocence, &c.

It would be difficult to give any distinct account of what Sir George said on the subject of colour; especially as he mentioned that he had been obliged to abridge and disarrange his remarks, in order that he might have time to say a few words also on sound. It is scarcely fair, therefore, to say any thing of this part of the essay. There is one part of it, however, which may be noticed. Sir George stated, that it is contrary to the true principles of reasoning, to explain the taste of one person, by means of any peculiarity in the taste of another, or the want of it. There were individuals,

and nations, so fond of mere colour, that, without attending to any particular arrangement, they decorated themselves, their houses, every thing around them, with glowing colours. There were others who had the power of discerning harmony in colours; but it was illegitimate to argue that, because one man daubs every thing about him with bright colours, there was no such thing as harmony of colour; which has been done, however, by the writer in the Encyclopædia. On the same principles it might be said, that there was no enjoyment in moderate eating or drinking, *because* there were gluttons and drunkards. Pink was not beautiful, *because* it was the colour of a rose, or the cheeks of a *young* woman. There are white roses, yellow roses, and some red and white, and red and yellow. Therefore there is no necessary connection between pink and a rose. There is *youth* in a Morisco woman, and a negress; why, in their cheeks, is not olive and black beautiful? as the beauty of the female countenance is not necessarily connected with innocence; hence a pink cheek, a part of that beauty, is not necessarily typical of purity of mind. Sir George had heard of a certain configuration of a red nose, called a *strawberry* nose; but on that account he could never consider the nose as beautiful, nor had he been cured of his predilec-lection for strawberries by this filthy association. If green be beautiful because it is the colour of grass, grass must have some quality which renders its colour pleasing; and the same quality must be shown to belong to the emerald and to the feathers of a parrot, which is impossible.

The same apology must be made for our imperfect account of what Sir George said with regard to sound. That there was something in simple sound which affected us agreeably or disagreeably, without the help of association, Sir George illustrated by the fact, that we do not choose musical instruments without trying the quality of their sound. A bell must have a fine ring; a piano-forte a fine tone; an organ a good voice; otherwise we reject them. Any piece of cat-gut will produce a given note when put upon a violin; but a performer is very nice in his choice of strings. Agreeable sounds are not necessarily connected with agreeable associations; and

disagreeable sounds often remind us of what is pleasing. The same bell announces good news, and that a friend is on his way to the grave. Sir George mentioned that he had always been very fond of the sound of thunder, and that he still enjoyed it as much and even more than ever, though he had been in great danger from lightning.

Music, Sir George observed, is addressed to our *feelings*, in most cases: and hence every piece of music is not universally admired; for some have different feelings from others, and one feeling stronger than another. But music can please without being so addressed. Sir George mentioned the case of one of his children who had shewn a very early disposition for music. This child takes likings to particular tunes, and always asks for his favourites. It is impossible that at an age between three and four years, a child can form associations. Sir George was convinced, however, that there is some character in particular pieces of music which harmonize with the child's natural dispositions. Sir George concluded, by observing that, though he would not at present attempt to demonstrate it, he was convinced that the connection which seemed to subsist between music and our natural dispositions, originated in the law of our nature, which appropriates certain intonations of voice to the expression of certain feelings. It was a splendid instance of the power and of the beneficence of the Creator, his having enabled us, out of seven simple sounds, with the aid of time, to range our enjoyment to an extent infinite and inconceivable.

Art. XV. *Proceedings of the Academy of Sciences of the Royal Institute of France.*

Sept. 16*th.* Our former account of this meeting was incomplete, in consequence of the hurry of our correspondent to send it off for publication. The following works were presented to the Academy:

Philosophical Transactions for 1816. *Part I.*

A Treatise on the Economy of Fuel. By Robertson Buchanan, *Esq.* Glasgow, 1 vol. 8vo.

Traduction complete de l'Almageste de Ptolomée, par l'Abbé Halma. M. Delambre was charged to give an account of this work to the class.

Voyage de Découvertes aux Terres Australes, Historique, 2me Partie, par M. Freycinet. 1 vol. 4to. Atlas.

Programme des Prix de l'Academie de Dijon.

The Secretary Delambre read a report on a memoir of Mons. Caddel, "On the Lines which divide each Semidiurnal Arc into Six Equal Parts."

Baron Larrey read a memoir, "*Sur les Effets des Balles perdues dans la Cavité du Thorax,*" as a continuation of his researches relative to the operation for empyema. MM. Pelletan and Deschamps were appointed commissioners for an account of this paper.

M. Chambon read a memoir, "*Sur le Système des Agriculteurs qui forment plusieurs Essaims avec les Abeilles d'une seule Ruche.*" MM. Bosc and Latreille appointed to examine it.

MM. Hauy and Ampère were named for the purpose of examining a memoir of Mons. Opoix, of which the title alone was read by the secretary, being "*L'Ame dans la veille et dans le Sommeil.*" Adjourned.

Sept. 22d. Messrs. Gay Lussac and Arago took their seats, on their return from England.

The last volume of the *Mémoires de l'Academie de Petersbourg* was presented, and a letter read, accompanying a bottle of indelible ink, from Mons. Aymez. M. Thenard was named one of the commissioners to examine the latter.

Professor Hallé read a report on the memoir of Mons. Majendie, already alluded to in the Journal of Science, respecting nutrition and the presence of azote in animals. The reporter, who seems to favour Mons. Majendie, doubts the veracity of certain writers, who assert, that there have been persons who have lived on substances not containing azote, such as sugar, oil, gum, &c. He particularly questions the instance, generally quoted, of the *caravan*; as it is probable, according to

his opinion, that travellers, who are said to have lived on gum only in crossing the deserts, drank camels milk at the same time! Mons. Lamark very properly observed, that the experiments, in order to be conclusive, ought to have been repeated on *herbivorous* as well as carnivorous animals, that some opinion might be formed of the relative effects produced on them and man. From the report, it appears, that with a view of ascertaining the effects produced on the digestive system by substances deprived of azote, M. Majendie examined both the chyme and chyle of the dogs on which the experiments had been made, and found the former to be of a very peculiar nature, while the latter presented some difference in its characters, according as it had been produced by oil or butter; that of the former is milky, while that, which is derived from the latter, and the use of gum, is more fluid and watery, and of a fine opaline colour. The report concludes with some favourable resolutions, which, after having been slightly opposed by some members present, were adopted by the Academy.

Mons. Dupuytren was called upon to read a memoir, for which his name had been inscribed; but not being present, and there being no other papers before the Academy, the President proceeded to remind the different members charged with making reports on memoirs read before the Institute, that more than the necessary time had elapsed for that purpose, and recommended that they might be made as soon as possible. Adjourned.

Sept. 29th. The minutes of the preceding meeting were read and approved. No correspondence. The following works were presented:

1. *Proceedings of the Board of Agriculture at Chalons.*
2. *Proceedings of the Academy of Sciences at Marseilles.*
3. *Notice sur l'Epizootie du gros Bétail, observed at the Veterinary School of Alfort.*
4. *Mémoire sur l'Inoculation du Claveau faite à l'Ecole d'Alfort.*
5. *Confutation de quelques Erreurs de Strabon.*
6. *Sur la Fabrication des Vins, &c. par* Julien.
7. *Traité des Maladies nerveuses, 2 vol. par* Villermay.

Mons. Jonnés distributed one hundred copies of his memoir on the *Géophages*, and of another on the Introduction of the yellow fever in the Antilles.

Several vacancies are announced to have occurred amongst the corresponding members of the Academy, in the section of Astronomy.

Mons. Cuvier read a memoir on the *Cephalopodes*, with a detailed account of their anatomical structure. The author observed, that the anatomy of these animals has been neglected by the naturalists, who entertained incorrect notions respecting it, till Monro exposed some of their errors, without, however, being himself completely correct. This circumstance induced Mons. Cuvier to undertake the subject of his present memoir. On speaking of the ink of the sæpia, the writer strongly opposes Monro's opinion of its being the bile of those animals. The construction of their eyes, hitherto unknown, has been ascertained by Mons. Cuvier to be equally beautiful and nearly as complicated as that of the most perfect vertebrated animals. It has, however, some singular peculiarities, which distinguish them from those of the latter—the non-existence of the anterior chamber, and the immobility of the pupil, which is formed by the external tunic. No choroid membrane is to be found in this organ. The clear manner and minute exactitude of details which so eminently distinguish this naturalist, seemed to prevail throughout this interesting paper, which, as we are informed, is only the first of a series to be read on the same subject. Many important facts, particularly on the nervous arrangement of the sæpia, and the physiology of their functions, are to be found throughout this memoir, which terminates with an observation of the author, that the complete anatomical knowledge of the *cephalopodes* he has thus acquired for the first time, induces him to consider these animals as beings completely insulated, and consequently as having been erroneously classed in some of the late systems of animal *genealogy*, where they are made to form one of the links of the great chain of animal beings. "No deviation in the ordinary form of this animal," says M. Cuvier, "has ever produced or can constitute a being placed

beneath it; nor can or ever will its better development give rise to a series of animals of a more perfect species to be classed immediately above it."

In the course of the meeting Mons. Bonpland presented the eighth livraison of the Rare Plants cultivated at Malmaison; and Mons. Boyer sent some notes on certain diseases, which being of a nature not to admit of being publicly read, were referred to Messrs. Pelletan and Deschamps for a report.

Mons. Brongniart read a report on a memoir of Mons. Marcel de Serres, on a new Geognostic Situation of a Calcareous Rock of fresh water Formation near Montpellier. This limestone is found on the banks of the Vidouvle, extending from Sommiére to beyond the village of Salinelle. It constitutes the hill of Montredon, rising to nearly 150 metres above the level of the river. This hill is composed of two distinct calcareous rocks — the superior is more soft and porous than the inferior; the latter is siliceous and compact, without any evident traces of stratification It is in this situation that the *magnesite* of Salinelle, better known under the name of *pierre à décrasser*, is found, and which Mons. de Serres is inclined to consider as belonging to the fresh water formation he describes. He gives the enumeration of the shells found in these two rocks, some of which seem to be new, or at least little known. Adjourned.

Sitting of the 7th of October. The minutes being read and approved, one of the Secretaries laid before the Academy the following works from their different authors:

The Triumph of Constancy, a poem, in six cantos, by Miss Porden, who was present at the meeting.

Traité élémentaire du Calcul des Probabilités, by Mons. Lacroix.

Note sur le Magnetisme Animal, &c par le Docteur Montégre.

Mémoire sur la Capillarité, par M. Sarthou. MM. Arago and Ampère were named commissaries to report on this work.

Journal of Science and the Arts, edited at the Royal Institution of Great Britain. No. III.

Journal de Pharmacie et des Sciences accessoires, for September.

Observations sur divers Fossiles de Quadrupèdes vivipares nouvellement découverts dans le Sol des Environs de Montpellier, par

M. Marcel de Serres. The Academy named MM. Cuvier and Brongniart to examine and make a report on this paper.

Mémoire sur l'Influence de la Polarization dans l'Action que les Rayons lumineux exercent les uns sur les autres, par M. Fresnel. MM. Arago and Ampère were directed to give an account of this memoir.

Mons. Delambre, one of the Secretaries, read a report on the second and last volume of a translation of Ptolemy's Astronomy, by M. Halma. Some remarks on certain passages of the report were made by Count Laplace, in which he endeavoured to support Ptolemy's astronomical reputation, particularly as an observer. To these remarks an eloquent, profound, and perfectly satisfactory answer was made by the reporter, who asserted it to be his firm persuasion, that Ptolemy could never have observed on any of the occasions on which he pretends to have done it, and that all his results were the mere offspring of incorrect calculation.

M. Dupetit Thouars read a memoir on the *Nomenclature of Plants.* MM. Desfontaines and Mirbel were named commissaries.

A short abstract of a memoir of Mons. Hachette, *Sur la Théorie des Lignes et des Surfaces courbes,* which was referred for examination to MM. Legendre and Arago, was next read.

The Academy resolved itself into a secret committee, for the discussion respecting the candidates proposed for the three vacant places of corresponding members in the section of astronomy.

Oct. 14*th.* After the reading of the minutes of the preceding meeting, a letter from Signor Vassalli-Eandi, Secretary to the Royal Academy of Turin, was read, in which he mentions having forwarded the seventeenth volume of the Transactions of the Societa Italiana, *Parte Fisica.*

The Bibliothèque Universelle for July, published at Geneva, was presented; also the following works:

Histoire des Polypiers corralligènes fléxibles, vulgairement nommés Zoophites, par M. Lamouroux. 1 vol. 8vo.

Monographie de Trigonocephale, par M. Moreau de Jonnés.

Nouvelle Nomenclature chimique d'après Thenard, par Caventon. M. Vauquelin is charged to examine this work.

Il buon Governo dei Bachi da Seta. Dal Conte Dandolo· 1 vol. 8vo. 1816.

Transactions of the Linnæan Society, 1816. Part I.

Mons Gay Lussac read an extract of a letter from M. Robiquet, announcing, that a woman had found at Tressignan, department des Côtes du Nord, in a ditch, a mineral substance, which she offered in vain for sale to several persons; but for which a silversmith gave her 900 francs, having ascertained it to be native gold, of $\frac{500}{1000}$ standard. M. Robiqnet sent a small specimen of the original mass to the Academy. The metal was implanted on a gangue of quartz, and of a considerable size; and it is to be regretted, that the Prefect did not make the acquisition of it, in order that it might have served as a guide for further researches.

MM. Deyeux and Thenard read a report on the memoir of M. Guichardiére, respecting the possibility of manufacturing excellent hats with the fur of the common otter. (See our last Number.)

The same gentlemen read a report on the indelible ink of Mons. Aymez, and expressed their opinion, that the ink in question did not possess the property attributed to it by the manufacturer.

A third memoir on Distilled Water by M. Lunel did not receive the approbation of the persons charged to examine it.

MM. Coquebert Montbret de Rossel and Brongniart present a report on a Map of the Island of Martinique, drawn up by Mons. Moreau de Jonnés, who used for basis of his work a map published about fifty years ago, by Moreau du Temple. The mineralogical constitution of the French possessions in the Antilles, the commissaries think, has not hitherto been well known. Mons. de Jonnés ascertained that all the mountains in the island are of volcanic origin: he found six extinct craters, and determined the limits of the eruptions. There is no granite. in the country, as some travellers have before asserted; but much calcareous stone containing fossil remains. here are, however, several additions to be made yet to this

map, such as barometrical elevations—sections of strata—a more particular account of the fossil remains—and an accurate examination whether the calcareous stone rests or not on volcanic rocks. M. Jonnés announces a collection of minerals, and promises a detailed work on the island. The commissioners take this opportunity of suggesting, that military and geological maps should be so constructed, as to be of mutual service to each other. The report concludes with an approbation of the map in question.

MM. Desfontaines and Mirbel read a report on a proposal of M. Cassini, junior, for establishing a new family of plants, called Boopideæ, which the commissaries adopt.

MM. Poisson, Ampère, and Cauchy read a report on a memoir of Mons. Hachette, relative to the *Ecoulement de Liquides, &c.*

The Academy proceeds to the election of three corresponding members in the section of astronomy, amongst the following candidates:

Mr. Pond, at Greenwich.
M. Bessel, at Koënisbergh.
Mr. Mudge, at Woolwich.
M. De Lindenau, at Gotha.
M. Bohrenberger, at Stuttgard.
M. Carlini, at Milan.

At the first scrutiny Mr. Pond had 34 votes; Mons. Bessel 33 on the second scrutiny; and on the third Colonel Mudge had 30 votes—the total of voting members present being 37. MM. Pond, Mudge, and Bessel were therefore duly elected corresponding members of the Academy.

Oct. 21. The Academy receives the following works:

Transactions of the Geological Society of London, Vol. III. with plates.

Tableaux chimiques du Règne animal, par M. F. John, translated from the German of M. Robinet, 1 vol. 4to.

Première et deuxième Leçons expérimentales d'Optique, sur la Lumière et les Couleurs, par M. Bourgeois.

M. Chevessaille proposes two new fire escapes. MM. Girard and Cauchy commissaries.

M. Pelletan read a report on a memoir of Mons. Elleviou, in which the author proposes to substitute the simple perforation of the cranium to the operation of trepanning, in cases where the latter is necessary. He says that a small and a simple hole, while it would be sufficient to give issue to the pus or any other secretion lodged between the bones and the dura mater, would also present the advantage of defending the latter membrane from the contact of external air, which seldom fails to produce very alarming symptoms, particularly in hospitals. M. Pelletan, however, objects to the smallness of the aperture, contending that the pressure of the external air would in that case more than counterbalance the pulsating elevation of the brain, and consequently impede the flow of extravasated pus or blood. He likewise asserted, that in no case whatever has the action of the external air on the dura meter after the use of the trepan, been productive of bad consequences. The author, therefore, says the reporter, is in error, both as to the proposition ot perforating instead of trepanning the cranium, and with regard to the possibility of evacuating the extravasated pus lodged between the bones and the membranes. In the first case, the author's anatomical knowledge seems to be defective; and in the second, he appears ignorant of the common laws of mechanic philosophy. Indeed the author has been particularly unlucky in the selection of examples: one of which is—that if a case occur, where the exact place of the accumulated fluid is not known, the operator should perforate the cranium here and there, till he hits on the right spot! The author allows, however, that in cases where it is necessary to elevate depressed bones, nothing can supply the trephine. The reporter concludes with proposing, that the memoir should be considered as never having been read (*comme non avenu*).

The same professional gentleman read another report on the memoir announced in our last Number but one (when the author's name was by mistake spelt Lavenu instead of Larrey), being a continuation of the one printed in his *Recueil*, on the Operation for Empyema. The Academy, on the pro-

posal of the commissaries, decrees that the memoir shall be printed among the memoirs of the *Savans Etrangers.*

M. Cuvier read a memoir on the Conformation and the Anatomy of the Hottentot Venus, who died at Paris last year, of a disease which the attending physicians could not well determine. M. Cuvier has dissected the subject, and presented the skeleton to the Academy. He intends shortly to publish his memoir in the "Annales du Musée d'Historique Naturelle."

M. Berthollet presents a report on a recent memoir of M. Dulong, on the Combinations of Phosphorus with Oxygene (see page 163 of Number III.). The reporter concludes with these words: "We find in the present memoir that sagacity which distinguishes the other researches of M. Dulong—a profound knowledge of chemical analysis, and results which had escaped the attention even of the most able chemists." The Academy resolves that the memoir shall be printed in the volume of the *Savans Etrangers.*

A memoir of Count Berthollet was next read, giving a Historical Sketch of the Rise and Progress of the Atomic Theory. In this paper the author has enumerated, in a concise but clear manner, the opinions and the experiments of Dalton, Thomson, Davy, Berzelius, Wollaston, Gay Lussac, and others, on the definite proportions observed in chemical compounds. After mentioning the difference which exists between Dalton's original theory and the development which Thomson gave to it, consisting chiefly in ascribing a different weight to the atoms, and in supposing a different number of atoms in the same compound, Count Berthollet proceeds to shew the distinction between Dalton's and Berzelius's system. The former considers the atoms simply as to their relative weight, while the latter determines them by their volume. The difference between these two methods does not produce any real difference in regard to the theory of combinations—but necessarily gives rise to a very great one in the indication and the comparison of the proportions with which the combinations are formed. Thus Berzelius considers water to be a

compound of 1 volume of ox. + 2 vol. hy.; whereas Dal on and Thomson give it as a compound of 1 atom o. + 1 atom hyd. It is, therefore, a binary compound, according to the latter; and a ternary one, if we adopt Berzelius's theory. The consequence will be, that the number representing the same compound in the two theories can no longer agree. M. Berthollet next explained the formulæ employed by Berzelius, to represent the different compounds; taking it for granted, that all gaseous bodies combine with each other in equal volumes, or as 1 : 2, 3, 4, &c. and gave the method used by the same chemist, for ascertaining the weight of the volume of the substance entering into the combination.

Sir H. Davy's method is next analyzed, and his manner of establishing and calculating the proportions of the bodies forming the combination, is clearly detailed. The general law of multiples in such cases, established by Berzelius, is not admitted by the English chemist, who proved that azote, for instance, follows certain particular laws in its combinations with other substances.

The first practical application that has been made of Dalton's atomic theory, is due to Drs. Thomson and Wollaston The former found, that the neutral oxalates become immediately bi-oxalates, by taking up a double quantity of acid, without forming any intermediate combination: while the latter proved, that carbonate of potash contains precisely double the quantity of acid which serves to form the sub-carbonate. Analogous observations have been multiplied, since that, by different chemists.

In tracing this historical sketch of the atomic theory, Berthollet pays a just tribute of praise to Proust, for his researches on the various oxides—as well as to Rouelle, for his distinction of *acid* and *sub-acid* salts, and to Richter, for his tables of the constant proportions found in neutral salts—tables, which have suggested the very ingenious and much more extensive synoptic scale of Dr. Wollaston.

Another of Richter's observations, namely: that metals, treated with an acid, produce a saturation equal to the quantity of oxygene in the oxide forming the combination—had

been neglected until Gay Lussac shewed, that oxides, producing the same degree of saturation, contain the same quantity of oxygene. We owe to the latter eminent chemist, the discovery of another important and constant principle, viz. the combination of gazeous bodies in simple proportions or volumes; and the simple relation between the apparent contraction of the volume, and the real volume of the gas itself.

After thus enumerating the different researches of the various chemists who studied the principles and laws of the atomic theory, by which science has been enriched with so many brilliant results, Count Berthollet asks to what cause ought we to ascribe the obscurity which still pervades this part of chemical science, and the difficulty which seems attached to it? This problem is of a comparatively easy solution. The difference in the numerical expression of the same atom or combination of atoms—the attempt at generalizing a law hitherto supported only by experiments made on a comparatively small number of substances—and lastly, the opinions of several philosophers, so much at variance with each other on the same subject; explain sufficiently why, with so many facts before us, we are at a loss how to form a code of indisputable laws on the theory of atomic combinations. Adjourned.

Oct. 28th. The Number of the *Annales de Chimie*, for August, was presented by the Editor to the Academy.

A letter from the Minister of the Interior was read, in which he informs the Academy, that Mons. Freycinet had been appointed to the command of one of His Majesty's vessels, for a voyage of discovery to the South hemisphere, and requests them to name a commission for drawing up the necessary instructions for such a voyage. The king having approved the measure, the vessel has been named, and is now ready to sail. The correspondence between the Minister of the Marine and Freycinet, on this occasion, was next read; when the Academy proceeded to name the commissioners for drawing up the demanded instructions. They are Messrs. Delamarck, Cuvier, Lacepede, Humboldt, Gay Lussac, Desfontaines, Von Buch, Biot, and Arago; the two latter, and

Delambre, being appointed by the Board of Longitude for the same purpose.

M. Desfontaines next read a report on a note of Mons. Virey, respecting the real nature of the *ergot* of rye, which he asserts to be a disease of the grain, and not a parasitic plant, as mentioned by Decandolle. Mons. Desfontaines, after giving the description of the ergot, enters into some elaborate researches respecting its growth, real nature, and external character, detailing, at the same time, the experiments made by Mons. Vauquelin, upon that substance. The reporter likewise details the opinion announced sometime ago, by Mons. Decandolle, that the ergot was a champignon, to which he had given the name of *sclerotium*, and that the seed of this parasitic plant was absorbed by the rye, and germinated afterwards. But facts, the reporter might have added, are not in support of this theory, and experience as well as experiments, prove the contrary to be the case. The report concludes with saying, " that although we do not reject altogether Mons. Decandolle's opinion, the experiments, and every other circumstance, must naturally induce us to adopt M. Virey's way of thinking on the subject." To the differences existing between the *ergot* and the *sclerotium*, mentioned by Mons. Desfontaines, M. P. Beauvois added, from his own observation, that there is another apparent character in the two substances, which alone would suffice to distinguish them from each other. This is the facility with which the grain of the *ergot* is detached from the plant; its friabilty, *pour ainsi dire*; whereas the *sclerotium* is horny, difficult to be cut, and not readily removed from the plant to which it adheres. He also stated having seen a plant, the lower part of which preserved its identic nature, while the upper half was *ergoté*.

Mons. Hazard suggested, that another means of ascertaining the difference between the *ergot* and the *sclerotium*, would be to institute some experiments on the effects of the latter on the animal economy, and to compare them with those which the *ergot* has been known to produce. (See Articles VI. and XI. of our last Number.)

M. Vauquelin read a report on a memoir of Mons. Dulong, on the combinations of oxygene and azote, and concluded with proposing its insertion among the memoirs of the *Savans Etrangers.* Approved.

M. Cuvier read a note on a fossil body, found generally in marine strata, and hitherto undecyphered by the naturalist. It is found commonly in the environs of Paris; and it has, by some, been considered as the claws of crabs, by others, as fossile teeth, &c. Specimens of these fossile bodies were presented to the class. The description was read, and it appeared, that the solution of this *geological puzzle,* accidentally occurred to Cuvier while dissecting the sæpia, on the anatomical structure of which he had lately been engaged. This fossile body is the hard and sharp part of the bone of that animal, as it is found even at present, with this difference only, that the *fossil* specimens are of a much larger size, and belong to an ancient world, but yet of so identical a nature with the modern, as to confirm us still more in the opinion, that "*La Nature des tems qui ne sont pas plus, étoit astreinte par les mémes loix que la nature d'aujourdhui.*"

Mons. Loiseleur read a memoir on a new classification of plants. Messrs. P. Beauvois and Mirbel, were named commissaries.

M. Laplace read a note *sur la Longueur du Pendule à Secondes.* This paper contains some observations on the manner of constructing a proper apparatus, in order to render the use of this instrument of the utmost exactness. One of the most important conditions in this case is, the choice of a proper absolute length in the pendulum, and that proposed and employed by Borda, seems to M. Laplace, by far the best, as leading to the most accurate results. The very little difference which exists between the results of twenty experiments, leave hardly any doubt on the correctness of the mean result. M. Laplace found, that in applying to those experiments, his formulæ of probabilities, scarcely an error of one hundreth of a millimetre could have occurred to Borda. But to render the absolute length correct, M. Laplace has ascertained, that the edge of the knife, instead of being linear, as commonly

thought of, is semi-cylindrical, and that its *radices*, instead of being added to, must be subtracted from the length of the pendulum.

Mons. Brongniart read a note on the *sodalite*, found on the summit of Mount Vesuvius, by Count Dunin Borkowowsky.

Messrs. Brongniart and Vauquelin were named Commissioners. The Academy resolved itself into a secret committee, for the presentation of candidates to fill the vacancies amongst the corresponding members in the section of geography and navigation. Adjourned.

Nov. 4th. The minutes of the last meeting were read and approved.

M. Cadet presents a memoir, entitled " *Cadastre de la France*. M. Salva sends a letter, in which he demands, that the Academy should call for a report on the new astronomical ideas which he has proposed to the Academy. This demand was referred to the section of astronomy.

M. Le Chevalier Gauffridi also asks for a report on his memoir, in which he has detailed a new demonstration of the *Parallelogramme des Forces.*

M. Deschamp, surgeon, read a report on a memoir of Mons. Boyer, on some surgical points connected with the diseases of the intestines.

Mons. Moreau de Jonnés read a memoir on the extinct volcanoes of Martinique, with a note on the several earthquakes which took place in that island. Messrs. Lelievre and Brongniart commissaries.

M. Montain, a surgeon in the Hotel Dieu, at Lyons, read a memoir on different points of surgery, proposing some new operations, and offering two or three new surgical instruments. At the same time. Messrs. Pelletan, Deschamps, and Dumeril, were named commissaries, for examining and making a report on the memoir to the Academy.

After a few concluding formalities, the Academy adjourned.

Nov. 11th. The minutes were read and approved. The following works were presented to the Academy.

Dissertation sur les Odeurs, sur les Sens et sur les Organes de l'Olfaction.

Traité d'Anatomie déscriptive, par M. H. Cloquet.

Hommage aux Mânes de M. Parmentier, par M. Bouriat.

Précis analytique des Travaux de l'Academie Royale des Sciences, Belles Lettres, &c. &c. Rouen, *tom.* XI. and the same *Précis for* 1816.

Annales de Mathematiques pures et appliqués, tom. 7, No. II.

Journal de Medicine militaire, par Mess. Biron *et* Fournier.

Mons. St. Hilaire read a memoir on the plants employed for extracting indigo, chiefly drawn from English publications, and particularly from the works of Dr. Roxburgh and Mr. Brown. Mess. Deyeux and Mirbel were appointed commissaries for a report. M. Cassini, junior, read a continuation of his memoir on the family of plants called the *Synantherées*. The present paper contains an analytical view of the *ovarium*, and its accessories. Mess. Delamark, Jussieu, and Mirbel, commissaries.

The Academy resolved itself into a committee for a discussion on the merits of the candidates, proposed by the sections of agriculture and veterinary art, to fill the vacancies of corresponding members. Adjourned.

Nov. 15th. Minutes read and approved.

Mons. Azais presents a copy of his work entitled "*Manuel du Philosophe ou Principes eternels précedés de Considérations générales sur l'Epoque actuelle.*

M. Hazard presents a note on the words "*Hippiatre, Veterinaire,* and *Mareschal.*"

Mons. Mello Franco sends a copy of his "*Traité d'Hygiène.*"

Mons. Almeida a translation in Portuguese of Cuvier's "*Traité d'Histoire Naturelle.*"

Mons. Victor Jorges demands a report on his "*Pompe centrifuge.*"

Lambert proposes to explain to the Academy a mode "*Accorder la Préscience divine avec la Liberté de l'Homme.*" Declined.

Mons. Poiutot presents a clock "*à reveil et à briquet.*" This

far what had already been effected, was correct, and might be confirmed.

M. Laplace thought it his duty to oppose the amendment, which was, however, carried by a large majority, and the prospectus with the amendment finally adopted.

The suspended report by Mons. Delambre, on a translation of another part of Euclid's works, by Mons. Peyrard, was read, and its conclusions adopted.

M. Ampēre read a report on a mathematical memoir of M. Berard.

M. Jambon presented to the Academy two new planetaries. Messrs. Burckhardt and Arago were appointed to examine them, and make a report.

M. Arago described verbally, the aurora borealis, which appeared at Paris on the 8th of February. The amplitude of the arc was 120°. The culminant point was situated in the magnetic meridian; in every other respect it resembled the aurora borealis so often described by Mairan.

A new arrangement and application of what is generally called Zamboni's pile, was presented to the Academy by M. Rousseau. In some of the columns, the manganese opposed to the zinc, is mixed with some pulverised oligistic iron; and the author pretends to have thus developed the magnetic fluid, by means of an accumulation of an electric and magnetic apparatus. A magnetic bar is made to move horizontally and alternately by the combined fluids; and a spark of some intensity, is given out at every contact of the bar with one of the poles of the arrangement. Messrs. Gay Lussac, Biot, and Thenard, were named commissaries,

Baron Larrey read an account of the amputation at the hip joint, performed by M. Guthrie, at Brussels, on a soldier of the French guard. Adjourned.

Feb. 17. Minutes read and approved.

The following works were received.

Journal général de Litérature de Jena. Oct. Nov. 1816.

Idem ——— ——— *de Leipsick. Idem.*

Bulletin des Sciences de la Société Philomathique. Jan. 1817.

Instruction concernant la Panification des Bléds.

The Rights of Literature. By M. Britton.

Journal de Pharmacie. Jan. 1817.

Two reports, on mechanical and mathematical subjects, were demanded, and commissioners appointed to draw up the same.

M. Vauquelin, in the name of the commission appointed to examine the memoir, sent to the Academy for the prize proposed by *M. Ravrio*, for finding an effective mode to prevent the bad effects of mercurial effluvia in the art of gilding, states that none of them have complied with the conditions, and proposes the further prorogation of the prize to next year. Adopted.

M. Beudant read a memoir on the mutual assistance of chemistry and crystallography in the scientific classification of minerals. To ascertain how far a foreign substance might be mixed with a salt without altering its essential form, the author made some experiments, by which it appears, that the form of the sulphate of iron, for instance, continues unaltered even when 97 per cent. of sulphate of copper are present.

M. Majendie read a memoir, giving an account of some experiments made with a view of ascertaining the action of arteries on circulation. The Doctor concludes from his observations—1st. That neither the larger nor the smaller arteries present any trace of irritability. 2. That they are dilated during the systole. 3d. That they are capable of contracting themselves with sufficient force on the blood they contain, so as to propel it into the veins. 4th. That the blood in the arteries is not alternately at rest and in motion; but that it is, on the contrary, in a continual succedaneous (*saccadè*, by little jerks) movement in the trunk and the ramifications; and uniform in the smallest ramifications and divisions. 5th. That the contraction of the heart and the contraction of the arteries, have a considerable influence on the course of the blood through the veins.

These conclusions are applicable to man and the mammiferous animals, on which Dr. Majendie has made his experiments; but he is far from drawing any inference in regard to those he has not had an opportunity to examine. MM. Percy and Biot were named commissaries for a report.

M. Virey read a note on the nature and generation of intestinal worms. Adjourned.

Feb. 24. M. Salvo demands a report on a memoir he presented to the Academy, on certain astronomical and trigonometrical discoveries he states to have made The Bibliothèque Universelle, for December was presented. A gentleman, whose name we could not learn, announces the invention of a spy glass by which objects may be seen at a distance, notwithstanding the interposition of elevated parts obstructing the direct sight. Another solution of the quadrature of the circumference, was presented to the Academy.

Colonel Grosbert presents a model illustrative of his intended ameliorations in scenic decorations, and explains, verbally, its construction.

MM. Majendie and Pelletier (pharmacien) read a memoir on ipecacuanha, in which they detailed some analytical experiments made on the psycotria ipec. cynanchus ipec. et viola ipec. They succeeded in separating the emetic principle from all, but in various proportions: the first yielded 16, the second 14, and the third only 4 per cent. of *emetine*, such being the name given to this principle. Adjourned.

Art. XVI. *Analytical Review of the Scientific Journals published on the Continent. Continued from page 453, Vol. II.*

The foreign journals appear very irregularly; we are therefore either subjected to the inconvenience of noticing in one review, four or five numbers of each, or to the no less unpleasant alternative of leaving them unnoticed, till their novelty, and much of their consequent interest, are gone by. In the present article, therefore, we balance our account with them to the conclusion of last year, for two only, have hitherto made their appearance in 1817.

Bulletin des Sciences, par la Société Philomathique.

SEPTEMBER.

Art. I. The four first articles have already been before our readers.

Art. V. *Mémoire sur la Variation des Constantes arbitraires dans les Questions de Mécanique; par M.* Poisson.

The generalisation of the theory of varying the *constante* of the elliptic movement of the planets round the sun; and its application to all the problems of mechanics in which a movement produced by certain given forces, is disturbed by others much smaller in proportion to the former, is due to the great Lagrange, and was one of his last, and not least elegant works.

The formulæ serving to explain and calculate this phenomenon, given by Lagrange in 1809, did not resolve the problem so generally, as those which were given a little time afterwards by M. Poisson, and which were almost the reverse of those of the former great geometrician. The result obtained by Poisson were in some respects particularly satisfactory, but as part of the problem remained still unresolved, he has, in the present memoir, endeavoured to shew that the differentials of the *constantes*, or at least a part of them, may be obtained by a method independent of the nature of the problem.

Art. VI. *Construction d'un Colorigrade; par M.* Biot.

We have announced the presentation of this instrument to the Academy by the author in a former Number; and endeavoured to explain its use from what we had heard from M. Biot himself, who explained its application for the purpose of determining, in a fixed and unalterable manner, the variety of colours occurring in organic and inorganic bodies, so as to be able to retrace them in a correct manner, and thus avoid the desultory mode of describing colours by terms of comparison, or by names which seldom convey to different persons one and the same meaning. We wish our time and limits allowed us to enter

further into the details of this elegant apparatus; but the length of the paper and the nature of it are such, as not to admit fairly of curtailment; and we should encroach on the space destined for other matter, were we to give a complete translation of the whole memoir.

Art. VII. *Supplément à la Théorie analytique des Probabilités, par M.* Laplace.

We suppose our readers acquainted with the great work of this eminent mathematician on Probabilities, to which the present is a kind of appendix. This supplement is divided into two parts. In the first the author gives some new developments to his method known under the name of *Methode des moindres carrés;* he exposes the means of facilitating the use of it, and removes certain difficulties, which the analysis of the numbers 19, 20, 21 of the second book of his work might leave. He next takes for example the observations of Saturn and Jupiter, calculated by M. Bouvard, and by which a mass has been given to Jupiter equal to $\frac{1}{1070}$ that of the sun. In determining the probability of this result, according to Laplace's method, we find a million to one, that M. Bouvard is right in his conjecture. The second part of the Supplement is relative to the probability of judgments—a question hitherto but incorrectly developed, notwithstanding its great importance to every class of society.

OCTOBER.

Art. I. *Sur un nouveau Gisement de Calcaire d'Eau douce près de Montpellier.* Par M. De Serre.

Art. II. *Expériences sur le Gas hydrogène-phosphoré.* Taken from the Annals of Philosophy.

Art. III. *Note sur un Individu qui peut avaler son langue.* Par F. Majendie.

To swallow one's own tongue is considered by modern physiologists as impossible. M. Majendie allows, that in cases of perfect conformation of the parts, particularly of the mucous membrane lining the internal surface of the lower jaw, and the

inferior portion of the tongue, this singular act cannot take place; but he also thinks, from what he has seen, that where any deviation in the regular conformation of those parts exist, the swallowing of the tongue is not impracticable.

The case he quotes is that of a foreign soldier, who having, when a child, seen a Jew double his tongue backwards, and plunge it with the greatest ease into the pharynx, began from that moment to endeavour to imitate him. The first efforts proved unsuccessful. At length he ruptured the frænulum, and a hemorrhage was the consequence, which did not alarm the boy, for he found from that moment he could better imitate his master. Continued repetition of this practice soon put him in possession of the singular faculty of swallowing his tongue, without the least inconvenience to his respiration.

Art. IV. *Essai géognostique sur l'Erzgebirge.*

This has been printed in the Journal des Mines some time ago. It is by M. Bonnard.

Art. V. *Observations sur quelques Combinaisons de l'Azote avec l'Oxygène, par M.* Dulong.

We have already noticed this paper.

Art. VI. This is an extract of M. Cassini's memoir on *a new Family of Plants.*

Art. VII. *Observations qui prouvent l'Indépendance absolue des Forces polarisantes qui font osciller la Lumière et de celle qui la font tourner, par M.* Biot.

From the experiments made by this eminent philosopher on the subject announced in the title of this memoir it appears, that the absolute independance of action existing between all kinds of attractive and repulsive forces presented to us by nature, holds good also with regard to the luminous molecules previously affected by either a double attractive, or a double repulsive refraction.

Art. VIII. IX. X. and XI. *already noticed.*

Art. XII. *Second Mémoire de M. Hachette sur l'Ecoulement des Fluides par des Orifices en minces Parois, et des Ajutages cylindriques ou coniques.*

We have already mentioned this memoir, which was read as far back as August, and an account of which will be found in a former number.

NOVEMBER.

Art. I. the same as Art. VII. in the *Annales de Chimie* for September.

Art. II. *Note relative à l'Article précédent.*

This article by M. Poisson gives some algebraic formulæ for obtaining the result mentioned by Laplace, when speaking of the absolute length of the pendulum, from which the radius of the semicylindrical edge of the knife must be deducted. These formulæ are distinguished by that accuracy and elegance, which characterise all the researches of this very profound mathematician.

Art. III. *Analyse chimique de plusieurs Mineraux* (taken from the Annals of Philosophy for September.)

Art. IV. *Sur la Succession des Couches qui constituent le Fond du Vallée du Rhône dans les Environs de Geneve, par M.* Poret Duval.

This memoir was read at the Society of Naturalists of Geneva, a few months back. The author beginning with the deepest strata known, enumerates the successive formations in the following order: 1st. Limestone raised by and leaning against the weft part of the Saléve. 2ndly, Strata of micaceous grès, constituting the hills of Cologny, Pregny, Chalex, &c. and forming the bottom of the lake. 3dly, A series of stratified marl to the number of fifty different varieties, containing some beds of *grés*, and presenting some varieties of a reddish and grayish colour, the latter being superior, the former are below. 4thly, Towards the superior part of the clayey formation, a bed of compact *marne gypsifère* is to be found, containing veins of

striated gypsum crossing each other in every direction. It is in this same part of the formation, that the author mentions having found a bed of combustible matter, which he calls *houille terreuse*, and which is said to contain some remains of fresh-water univalve shells. 5thly, The whole is covered by a thick bed of rounded pebble-stones, more or less cemented together by marl, which is 20 metres (65.5 feet) thick, where it dips under the present channel of the river Arve.

Art. V. *Sur la Réunion de la Lepidolithe avec l'Espéce des Mica, prouvée par la Comparaison des Forces polarisantes, par M.* Biot.

It had been suspected, but never proved, that the lepidolithe belonged to the species mica; but the want of regular crystals, and some difference in the chemical analysis of these two substances, had left the point undetermined. M. Biot, however, having observed, that the characters, as derived from the intimate and essential properties of minerals, do not present the smallest difference, is inclined to believe that the two substances in question are perfectly identical. The following are M. Biot's observations: 1st. Mica is the only crystallised substance hitherto known presenting two axes from which two polarising forces are emitted—the lepidolithe has two axes also. 2ndly, One of the axes of the mica is situated in the plane of its laminæ, and the other perpendicular to them; the same in the lepidolithe. 3rdly, Both axes in mica are repulsive, and so they are in lepidolithe. 4thly, In mica the normal axis is the most energetic, and its intensity is to that of the other axis as 677 is to 100. Exactly the same proportion may be observed in the lepidolithe. The polarising forces of the two substances are therefore the same.

Art. VI. *Sur la Sodalite du Vesuve, par M. le Comte* Dunin Borkowsky.

Art. VII. *Sur la Déperdition de Calorique qu'occasionne le Rayonnement des Corps vers le Ciel*

Mention is made in this article of the fact ascertained by Dr. Wells, and proved by an elegant experiment by Dr. Wollaston, who did not, however, anticipate the real theory of it, first imagined by the former, that if a substance be exposed to

the open air at night, in calm and serene weather, its temperature will soon become lower than that of the surrounding air. Dr. Wollaston exposed a concave metallic mirror turned upwards, to the free air, with a thermometer placed in its focus, and proved the lowering of its temperature after a short time of its being thus exposed.

This article, written by M. Biot, concludes with these words; "Nous devons la connaissance de cette belle expérience à M. Wollaston lui-même, ainsi que les restrictions indiquées relativement aux conséquences qu'il en avait déduites. Personne n'ignore que, dans ce célèbre physicien, la candeur et l'esprit de justice, ne le cèdent point à l'invention."

Art. VIII. *Notice sur la Structure du Vallon du Locle, par M. de* Van Buch.

This memoir is taken from a manuscript of the above eminent geologist, now in the possession of the city of Neufchatel, and communicated by D. Berger of Geneva. The Valley of Locle is situated in the canton of Neufchâtel, and 2956 French feet above the level of the sea. The geological description of it is given, with many curious details, to which M. Brongniart has added some important notes and illustrations.

Art. IX. *Sur une Femme de la Race Hottentote, par M.* Blainville.

This description of the Hottentot Venus was read at the Philomathic Society in 1815; it consequently contains nothing new. We need only remind our readers, that Dr. Somerville, one of the principal inspectors of hospitals of the British army, who resided some time at the Cape of Good Hope, has given a complete and elegant description, in Latin, of this singular race of people, published in the Transactions of the Medico-Chirurgical Society of London.

Journal de Pharmacie et des Sciences accessoires.

AUGUST, 1816.

Art. I. *Mémoire sur la Gomme d'Olivier, par M.* P. Pellitier.

(See our Third Number, page 176.) In this memoir we find

the principle discovered by Pelletier in the above gum, called *Olivile*, and no longer *Olivine*, to distinguish it, no doubt, from the mineral substance bearing the latter name.

Art. II. is taken from the *Annales de Chimie.*

Art. III. *Perfectionnement des Appareils Portatifs destinés à la Purification de l'Air d'après les Procédés de G. Morveau, par M.* Boullay.

We cannot, without the assistance of the plate, and without entering into details, which would be long and tedious, give an account of this *perfectionnement*, which seems to consist chiefly in the employment of glass bottles containing *chlorine*, having a conic opening, and a conic stopper, kept down, when not in use, by a forcing screw, which may be turned at pleasure, from outside of the box containing the apparatus. When it is wished to allow the gas to escape, it is only necessary to open the forcing screw, and the stopper being raised by the expansion of the gas, the latter will issue from the bottle and the box through two openings made in it for that purpose.

Art. IV. Describes an improved pounding mortar for apothecaries and druggists.

Art. V. *Quelques Expériences sur l'Ail, par* Bouillon La Grange.

Garlic had already been analysed by Neumann and Cadet Gassicourt. M. Lagrange therefore simply adds some facts observed by him in the course of some recent experiments made on that substance. The result of these experiments gives us for the composition of *garlic* the following substances.

1. A very acrid and volatile oil.
2. Sulphur.
3. A small quantity of mylaceous fecula.
4. A Vegetable albumen.
5. A saccharine matter.

Each of these substances, when separated, preserve still a strong smell of garlic, in consequence of retaining the volatile oil. The sulphur is obtained, combined with hydrogen, on distilling garlic with water.

Art. VI. Taken from the *Bibliothéque Universelle*, pag. 129, tom. I.

Art. VII. continuation of M. Guibourt's memoir on mercury and its combinations with oxygene and with sulphur, mentioned in No. III. of our Journal, p. 171.

Art. VIII. *Formule du Sirop sthénique amer et composé.*

This article belongs more particularly to a journal of medicine. We shall only observe, that if the virtues of a pharmaceutic preparation depend upon the number of its ingredients the present syrup must be an admirable remedy. It contains no less than thirteen substances. "Si l'on ajoute, (says the learned editor) sublimé corrosif gr. IV. à chaque demi-bouteille, on a le syrop sthénique *composé*;" the former one being, of course, *quite simple.*

Art. IX. *A Review of a French Translation, by MM. Vagel and Bouillon La Grange of Remer's* Police Judiciaire Pharmaco-Chimique.

Art. X. *Ordonnance Royale relative au "Codex Medicamentarius."*

We are glad, for the sake of the French, to see this arrêté of the King; it does not come sooner than it was wanted. Every stranger must have been astonished at finding the apothecaries in France without a "Pharmacopœia Gallica" to guide their operations.

SEPTEMBER.

Art. I. *Fragmens de nouvelles Recherches sur l'Origine du Sucre de Canne.*

Art. II. *Sur l'Eau de Vie de Pommee de Terre.*

Mon. Cadet thinks that from 800 pounds of potatoes about 30 of spirit of wine might be obtained by following a method which he details. This operation would cost about 36 francs and produce nearly 48.

Art. III. *Observations de Physique végétale. Epis de Blé d'une apparance métallique.*

There has been lately found under the foundation of an old house a cellar containing a quantity of ears of corn preserving

nearly the same appearance, that they have when fresh, except that the grains are completely carbonised, and possess a metallic lustre not unlike that of sulphuret of lead. The grains adhere to each other; they are particularly light, friable, and their volume a little increased. Exposed to the air, they experienced no change whatever.

The author (M. Virey) discusses the cause of this phenomenon, and tries to ascertain the epoch at which this collection of wheat was thus concealed.

The next three articles are not deserving of any particular attention.

Art. VIII. An extract from Dr. Ferriar's Medical Histories and Reflections.

Art. IX. *Eaux minérales de Nevis.*

The analysis of these mineral waters is mentioned merely to shew that it cannot be correct.

Art. X. *Lettre de Mons.* Desvaux *sur le Chouan et sur un Poivre factice.*

From an accurate examination of the botanic characters, and from analogy, the author thinks there can be no doubt that the *chouan* is the same as the *Anabasis tamariscifolia.* Mons. Desvaux takes this opportunity of giving some *éclaicrissemens* respecting the factitious pepper, which is sold in the provinces of France, and which had already been noticed by the editors of the *Journal de Pharmacie.* Mons. Desvaux has ascertained that it consists of grains of the *brassica napus,* over which a paste made of flour mixed with a little powder of cayenne pepper, or mustard seed, is carefully laid and dried. On the fabrication of this *drogue* the author gives some interesting details, obtained from one of the men who hawks it in the country. The manufactory is established at Lyons.

The two next articles are reviews of recent chemical and pharmaceutical works.

Art. XIV. *Dissertation sur l'Acide tartarique et sur sa Combinaison avec l'Acide borique, &c. Par Mons.* Thevenin.

We find nothing new to engage us to enter into the analysis of

this memoir. What the author says of the combination of the two acids in question, and the solubility imparted by the latter to the former, had been announced sometime before, by another French *Pharmacien*, in the *Journal de la Société des Pharmaciens* of Paris.

OCTOBER.

Art. I. *Essai sur une Classification des Principes immédiats des Végétaux. Par* M. Desvaux.

This is only an attempt which the author promises further to develope by other researches and observations. The author begins by establishing a difference between the immediate produces of vegetable bodies, and their immediate principles. The latter he endeavours to bring into one collective view in order to facilitate their study. The principles on which his classification is founded are next detailed; and these are followed by the classification itself. M. Devaux divides his immediate vegetable principles into three great classes, the first of which contains the *principles of vegetables* common to animals and mineral substances. This class contains *four* orders.

Or. 1st. *Oxides* containing six species.

Or. 2nd. *Non-metallic combustibles* containing one single species.

Or. 3rd. *Salts* containing 44 species.

Or. 4th. *Water.*

In the *Second Class* we find the substances, or principles common to vegetables and animals. This contains one order only, and six genera.

The *Third Class* is destined for the *principles* proper to vegetables. It is formed of

Or. 1st. composed of carbon, hydrogene, oxygen, and azote: containing

Genus 1.	- -	Ferment.
———2.	- -	Narcotine.
———3.	- -	Crystallinite.
———4.	- -	Hematine.

Or. 2nd. composed of carbon, and hydrogene and oxygene in excess: containing the acids consisting of 15 species.

Or. 3rd. composed of substances with carbon, and hydrogene

and oxygene in the proportions proper to form water. It contains.

Genus	1. - -	Liquite.
———	2. - -	Feculite.
———	3. - -	Saccharinite.
———	4. - -	Gommite.
———	5. - -	Amarinite.
———	6. - -	Polychronite.

Each genus being subdivided into a number of species. There are two doubtful genera attached to this order.

Genus	1. - -	Tanin.
———	2. - -	Extractive.

Or. 4th. composed of carbon oxygene and hydrogen, the latter in excess : containing

Genus	1. - -	Gluine.
———	2. - -	Wax.
———	3. - -	Oil.
———	4. - -	Scilline.
———	5. - -	Aromite.
———	6. - -	Resinite.
———	7. - -	Resino amarinite.
———	8. - -	Caout-chouc.
———	9. - - -	Camphor.
———	10. - -	Olivile.
———	11. - -	Picrotoxine.

Some of these genera being subdivided into species.

Art. II. *Lettre à Mons.* Virey *sur l'Angusture veneneuse.*

Art. III. *Déscription des Angustures du commerce de la vraie, et de veneneuse.*

In one of the late numbers of the Medical Repository a translation of a very interesting paper from a German physician, is published, in which we find all the necessary information on the subject of the false and true Angustura, with an account of the effects of the former on the human œconomy.

Art. III. is an account of some pharmaceutic manipulations performed by means of the filtre press of Mons. Real, described in a former number of this Journal.

Art. IV. Is a pharmaceutic preparation.

Art. V. *Sur lè Vin de Poules.*

What is the *Vin de poules* ? our readers will ask. Let us consult Mons. *Cadet de Gassicourt* ; who tells us, *avec le plus grand serieux du monde*, that if we take a certain quantity of the excrements of hens (it must not be a cock !), dry them, and carefully separate the white portion from the rest, and next infuse two ounces of it in a *litre* of white wine, taking care to shake the bottle well containing the infusion, from time to time, and ultimately to filtre the liquid ; we shall have the desired preparation.

But our readers may perhaps suggest, that this is not, properly speaking, a *vin de poules*, but rather good white wine spoiled by the *excremens de poules*. No matter ; Mons. Cadet will again inform us, that if we take the trouble of swallowing two glasses full of this wine, morning and evening (though it should even create nausea,) when we experience any difficulty in the secretion of urine, we shall doubtlessly find immediate relief from it, and experience an acceleration in the general circulation. All this may be well and good, but we should prefer a cup of his *chocolat de santé*, or to masticate a dozen of his *tablettes aromatiques*.

The remaining articles of this Number are not of a nature to be analysed in this place. The last is an abstract of Sir H. Davy's paper on Flame.

JOURNALS PUBLISHED IN SWITZERLAND.

Bibliothèque des Sciences et des Arts. Geneva, (Monthly.)

SEPTEMBER.

Art. I. *On Comets.* By H. Williamson.

It is an extract from the Transactions of the Literary and Philosophical Society of New York.

Art. II. *Bemerkungen über die Blauefarbe, &c.* or, Observations on the the blue colour of milk. By Dr. Bremer.

That the milk of cows has more or less a blue tinge, and in some cases of considerable intensity, no one will deny. Dr. Bremer has had occasion to see it when churned, as blue as

indigo; and Klaproth found that the colouring matter in such cases, presents exactly the same phenomena as that substance, when treated with the various chemical reagents. Is this change of colour in the milk the effect of diseased secreting organs, or the mere consequence of a particular kind of food? The author is decidedly of the latter opinion; and to prove its accuracy, instituted some experiments; when he found that cows which were fed with sainfoin in two days secreted a milk of a remarkably fine blue tinge; while by changing their food the milk was restored to its wonted whiteness, still, the same phenomenon does not take place with all the cows similarly fed. We must therefore admit a particular disposition of the secreting organs of the animal. From the want of action of an alkaline ley on the blue colour, adhering with the utmost tenacity to the wooden vessels in which the milk in question has been long kept, Mr. Hermbstaed (who has added some notes to this paper) deduces the impossibility of any prussic acid being the cause of this singular alteration.

Art. III. relates to M. Porrett's galvanic experiments inserted in the Annals of Philosophy for July last.

Art. IV. *Leçons de Géologie,* &c. Par Delametherie. See our last Number, page 429. We differ *toto cœlo* from the present reviewer,

Art. V. *Observations on the Communication of contagious Diseases.* By Dr. Hosack of the University of New York.

Art. VI. to X. are from English publications.

Art. XI. *Lettre de* M. Biot, *Membre de l'Institut, au Prof.* Pictet.

The review of M. Biot's Traité de Physique in the Bibliothéque Universelle has given rise to many explanations, and to a correspondence between the author and the reviewer. The object of the present letter is to correct an error which has occurred in a former one printed by Mons. Pictet in the same Journal respecting the principles of movement and equilibrium. By a transposition in the original copy of the former letter M. Biot was made to give the permanence of the celestial movements as a proof of the proportion between the velocities and the

forces; whereas it was his intention to assert, that those movements are simply a proof of the *vis inertiæ*.

Art. XII. *Traduction, in parte quâ, d'une Lettre aux Redacteurs de la Bibliothèque, écrite de Pise.*

The subject of this anonymous communication relates to the action of flame on combustible bodies; and to the transmission of heat. The writer asserts that he succeeded in completely melting tin, and even lead, contained in a small copper vessel, without burning, or otherwise injuring a piece of common linen cloth, which he had applied externally to the vessel, and had been exposed to the immediate contact of the flame during the whole time of the operation. Water was boiled in another vessel of brass, and the same phenomenon observed with regard to a piece of cloth exposed to the action of the flame of a candle in the same manner.

OCTOBER.

Art. I. *Astronomisches Jarhbuch,* &c. or Astronomical Ephemeris of Berlin for the year 1818, calculated and published by M. Bode, Astronomer Royal.

The nature of all these books is pretty generally known; they must all necessarily resemble each other, and can only be distinguished by more or less accuracy and skill displayed in their compilation.. The present one seems to deserve the particular attention of astronomers, and contains much useful information.

Art. II. *Procédé pour l'Analyse de la Terre végétale,* in a letter from M. Schübler to Saussure, jun.

To separate the nutritive part of arable soils, the author employs crystallised carbonate of potash; the analysis would be inexact if caustic potash were employed, as the latter dissolves silex, and a considerable portion of the vegetable fibre. The solution has a brown colour, which is more or less intense, according as the soluble matter is more or less abundant. After filtering the solution, M. Schübler submits the dried,

and weighed residue to the action of fire, and thus ascertains the proportion of vegetable matter and charcoal it contains: muriatic acid is then carefully added, till no further formation of flocculent matter in the liquid is perceived. This is literally the process first employed by Professor Crome.

Art. III. *Elémens de Physiologie végétale et de Botanique, par* Brisseau Mirbel, 3 vol. &c.

See our Third Number, in which the substance of this work was given.

Art. IV. *Notice sur les Serpens de la Suisse, par M.* Wyder.

There are five species of these dangerous reptiles, which the author has examined, and which seem more or less abundant in Switzerland. These are the common viper, the *coluber fulvus*, the *coluber natrix*, the Austrian snake, and the Anguis. Their description adds nothing to the information already contained in every book of zoology.

Art V. VI. and VII. we have elsewhere noticed.

Art. VIII. *Notice des Séances de la Société Helvetique des Sciences naturelles, réunie à Berne le* 3. 4. *et* 5. *Octobre*..

The nucleus of a Society for promoting the knowledge of Natural History, was, it appears, first formed in October, 1815, at Geneva, by the late M. Gosse. Several naturalists went thither from various parts of Switzerland: the plan and regulations of the Association were drawn up, and it was finally determined, that the members should assemble every year, and for three consecutive days, in one or other of the principal towns of that country. The first meeting was held at Bern, in October, 1816. The President opened the assembly with a speech in the German language, in which he set forth the motives for establishing such an Institution, and detailed at full length the objects which the Society had in view. There were present sixty-six members from different Cantons, who, after the first day's meeting, visited the various apartments in the house of the Society, containing a fine cabinet of natural history, and a rich and extensive library, besides a con-

siderable botanic garden. Amongst the foreign members, we perceived with pleasure, the name of Sir John Sebright, Bart. M. P. who had assisted at the first meeting. A sum of 600 francs having been granted by Government to the Society, the latter decided, that it should be employed in establishing an annual prize for the best paper on natural history. We congratulate the Swiss nation, and her learned men, on this meritorious undertaking, from which so much good is likely to result to science in general.

Art. IX. X. XI. are taken from English Journals.

Art. XII. is a letter from Professor Eynard to Mons. Pictet, sending the latitude of the Observatory of Beaulieu, determined by him with the theodolite of Schek after several observations. It appears to be 46°. 26′. 57.″ 25.

NOVEMBER.

The seven first articles are from English works, or have already been before us.

Art. VIII. *Ueber das Zerspringen der Dampfmaschinen, &c.* or, On the Explosions of Steam Engines. By the Chevalier Baader.

The author, whose name must be familiar to our readers, takes pains to persuade his countrymen of Munich, that the many dangerous accidents produced by the explosions of steam engines, of which several have lately occurred both in England and America, are by no means inherent to the machine itself, but must be ascribed to the several defects in their construction, owing to pretended amelioriations introduced by ignorant persons. None of the thousands of machines, large and small, constructed by Watt, whose establishment the author has had an opportunity of examining, have ever exploded; and we should have never heard of such an accident, perhaps, if Mr. Richard Trevithick, of Cornwall, had not proposed another steam engine of quite a different construction. The condenser being done away with, he has made the steam act on the internal surfaces of the recipient, with an elasticity

equal to 6 or 8 atmospheres; and hence the danger of explosions. The Chevalier concludes his paper by casting some ridicule on the idea of employing a steam engine as a substitute for horses, in drawing carts and post-chaises.

Art. IX. *Notice of Experiments on Flame, by Sir* H. Davy.

(See our Journal, No. III.)

Art. X. *Sur la Quadrature du Cercle* (avec fig.)

We have no paper to waste on this subject.

Art. XI. *Proceedings of the Royal Academy of Sciences at Paris in September.*

(See our Journal, No. III.)

Art. XII.

The purport of the letter constituting the present article is to correct some misstatement which occurred in the memoir of Mons. Marcel de Serres of Montpellier, on the fresh water formations near that town, of which we have given an account in our review of the Bulletin des Sciences de la Société Philomathique de Paris.

Art. XIII. *List of Foreign Publications.*

Art. XIV. *Meteorological Table.*

DECEMBER.

Art. I. *D'un Instrument astronomique doublement repetiteur, et d'une Methode d'Observation qui lui est particulière. Par* D. Devecchj, *late Professor of Astronomy at Florence.*

This instrument consists in the union of the repeating circle of Borda, and the double repeating theodolite, by which the author professes to have performed with the utmost exactness all sorts of astronomical operations.

Art. II. *Commentari sopra la Storia e la Teoria dell' Ottica, by the Chevalier* Venturi.

The name of the author is advantageously known in England, through several very interesting memoirs on optics. The present is an historical sketch of the origin and progress of

that science, and as such not susceptible of being analysed in a short compass.

Art. III. *Chemische Tabellen,* or *Tableaux chimiques du Règne animal. Par le Dr.* John. *Traduites en Français par* Robinet. 1 vol. 4to.

We have mentioned somewhere in our Journal the translation of this work, which we consider as likely to prove of great service to the practical chemist, and to the medical profession in particular.

Art. IV. Extracted from the London Medico-chirurgical Transactions, and relates to the operation for artificial pupil, by Professor Maunoir of Geneva.

Art. V. *Esquisse mineralogique des Environs de la Chaussée des Géans. Par M.* B.

This is little else than a catalogue of geological and mineralogical substances observed in the course of a tour through the North of Ireland. After the very elaborate Memoir on the Geology of a part of that county, contained in the third volume of our Geological Society, the reader can scarcely expect more information in a short and meagre collection of notes on the same subject.

Art. VI. is a review of a botanical work on the medical and economical nature of the *Solani.* Not having seen the work itself, we cannot say how far the observations of the reviewer are correct.

Art. VII. *Proceedings of the Royal Academy of Sciences at Paris, for September.*

(See our Third Number.)

Art. VIII. *Lettre du Professeur Maunoir à Mons. Pictet sur un Perfectionnement introduite dans le Chalumeau de Newman.* (Brooks's.)

The improvement here suggested, with the addition by the editors, is exactly the same as that which Mr. Edwards first

proposed, and published in the Medical Repository of London. Like it, is insufficient for the purpose for which it was intended, as the gases will have lost the great advantage of being compressed, when they are made to issue from separate boxes, again to combine in a small and common reservoir.

Art. IX. *Lettre aux Rédacteurs de la Bibliothèque Universelle sur la Notation numérique.*

This Paper refers to the Xth. Article in the Number for November, relative to the quadrature of the circle, or the proportion between a circumference and its diameter. We may say the same of Article X, containing a letter from M. Shaub on the same subject.

Art. XI. *Apparition d'un Météore igné.*

On the 11th of December, 1816, at 46 minutes past five o'clock P. M., M. Stark observed, at Augsburg, a fiery meteor, resembling in light, colour, and apparent diameter, the full moon when seen through light clouds. It appeared to have a west south-west direction, and rapid. In eight seconds, from the moment of its appearance, it had reached the meridian; and in six seconds more had ceased to become visible. It seemed to drag behind it a zig-zag tail, the length of which was three times that of the diameter of the body. Next follow the enumeration of the observations made at the time, with several meteorological instruments.

Art. XII. *Meteorological Table.*

JOURNALS PUBLISHED IN FRANCE.

Journal de Physique par M. Delametherie. November, 1816.

Art. I. *Mémoire sur les nouvelles Propriétés de la Chaleur à mesure qu'elle se developpe dans sa Propagation le long des Morceaux de Verre, par* David Brewster.

Translated from the Philosophical Transactions. Part I. 1816.

Art. II. *Récherches sur la Respiration des Plantes exposées à la Lumière du Soleil, par* M. Richland.

De Saussure found, that a considerable portion of the oxygen given out by plants in day time, was derived from carbonic acid present in the atmosphere gradually decomposed by the vegetable bodies exposed to solar light; and that the carbon thus set free served to augment the volume of the plant, where no other means of subsistence existed. The inspiration of oxygene gas by plants at night, and its expiration in the day, were also two phenomena which Saussure examined with particular attention; and he deduced from his observations a confirmation of his former opinion respecting the decomposition of the carbonic acid by vegetation. M. Richland, however thinks that all these phenomena may be explained otherwise, and without having recourse to a decomposition, in other cases so difficultly effected. He thinks, that the excess of oxygen given out by plants in day time above the quantity absorbed during night, is ready formed in the plant itself, and its expiration favoured by the presence of the carbonic acid, which is in its turn absorbed to occupy the place of the oxygen. This hypothesis led him to the institution of several experiments to prove the influence of various acids, and other substances in facilitating the expiration of oxygen by vegetable bodies. We have collected, in the form of a table, the results he has obtained, assuming the mean produce of several experiments. The leaves employed were those of the *Sambucus nigra.*

Liquid Mixture.	Volume of air disengaged in inches.	purity of the air disengaged.
Spring water - - -	4.7	0.47
Water boiled for two hours -	1.5	0.34
Water + sulphuric acid - -	7.0	0 31
Water + muriatic acid - - -	20.6	0.73
Water + $\frac{1}{1000}$ muriatic acid - -	17.0	0.70
Boiled water + nitric acid - -	9 0	0.66
Water + muriatic acid in the dark -	0.0	—
Water + nitric acid - - -	17 3	0.65
Water + acetic acid - -	24.5	0.79
Water + carbonic acid, saturated at 12°	7.2	0.45
Water + carbonic acid, ditto, mixed with $\frac{1}{2}$ its quantity distilled water -	22.0	0.76
Ditto ditto mixed with $\frac{3}{4}$ of distilled water - - -	24 0	0.78
Water + ammonia - - -	0.0	—
Lime-water - - -	0.0	—
Water + carbonate of potash - -	0.0	—
Water + muriate of ammonia - -	6.5	0.51
Water + acetate of potash - -	3.5	0.30
Water + nitrate of potash - -	11.0	0.55
Water + muriate of soda - -	4.7	0 36
Water + tartrate of potash - -	16 0	0.56
Water + potash - - -	0.0	—
Water + alcohol - - -	1.2	0.21
Water + chlorine - - -	4.7	0.46
Water + $\frac{1}{1000}$ of chlorine - -	3.5	0.36

N. B. Whenever the quantity of the acid is not expressed in numbers in the above table, it is to be understood to have amounted to $\frac{1}{6000}$ of the water employed. The salts were used in the proportion of 3 drachms each; but M. Richland forgets to give the quantity of water used in the experiments. The eudiometric means employed to ascertain the purity of the air given out, were the washing it with lime water, and analysing it with sulphuret of potash.

From the above experiments M. Richland thinks he may infer, 1st. That the acids of some salts are favourable to the respiration of plants; 2dly, That, in the dark, they augment

the inspiration of the oxygene gas; and exposed to the solar light, increase the expiration of it, the plant absorbing the acid or the salt in its stead.

We are not prepared to decide on this question.

Art. III. *Suite du Supplément au Mémoire sur la Réduction des Degrés du Thermomètre de Mercure en Degrès de Chaleur réelle, par* H. Flaugergues.

(See the last Number of this Journal, page 436.)

Art. V. *Meteorological Table, by* M. Bouvard.

Art. VI. *Suite du Mémoire sur les Substances minérales dites* EN MASSE *qui entrent dans la Composition des Roches volcaniques de tous les Ages, par* L. Cordier.

The present paper contains the concluding part of M. Cordier's interesting memoir, noticed in our last Number, p. 434. At the end of the memoir we find the following important systèmatic arrangement of the volcanic masses.

Distribution méthodique des Substances volcaniques dites en masse.

Section I.

Feldspathic substances; *in which the particles of the feldspath are greatly predominant.*

A) unaltered.

TYPE I.*

Exclusively composed of microscopic crystals, of an equal size, adhering by their simple juxta-position, with greater or smaller spaces between them.

LEUCOSTINE.

Sub-types.

a. Leucostine (compact) *Synon.* Petrosiliceous lithoid lavas; sonorous compact felds-

* M. Cordier calls Type what M. Haüy would call *principal modification* of any two predominant species, and which Werner calls *species.* The Sub-types, therefore, in the present method, answer to the sub-species of the latter, and to the principal varieties of the former eminent mineralogist.

Sub-types.				path, klingstein, phonolite, volcanic hornstein.
b.	Leucostine.	(scaly)	*Synon.*	A new sort, in which many of the crystals of feldspath are flat, and placed in the same direction: graustein of Werner?
c.	———	(granular)	———	Domite: basis of part of the thonporphyries of Auvergne, and probably of Hungary: basis of part of the trap porphyries of Humboldt.

Type II.

Composed of a puffy glass, with a mixture of microscopic crystals more or less abundant.

PUMITE.

Sub-types.				
a.	Pumite	(grumous)	*Synon.*	A new sort, having a lithoid aspect.
b.	———	(heavy)	———	Pumice stone (heavy) of Spallanzani and Dolomieu.
c.	———	(light)	———	Common pumice stone: lave vitreuse pumicée of Haüy.

Type III.

Composed of massive glass, with almost always a mixture of microscopic crystals more or less abundant.

OBSIDIENNE.

Sub-types.				
a.	Obsidïenne	(perfect)	*Syn.*	Obsidian; vitreous uniform lava. Feldspathic glass.
b.	———	(smalloide)	———	Opaque, vitreous lava, volcanic pechstein; pechstein.
c.	———	(imperfect)	———	A new sort, having an aspect between vitreous and lithoide.

Type IV.

Composed of crystals and microscopic vitreous grains not adhering together.

SPODITE.

Sub-types.

a. Spodite (cristalliferous)	*Syn.*	White volcanic ashes.
b. ——— (semivitreous)	——	Pumice stone ashes.
c. ——— (vitreous)	——	Idem.

Type V.

Composed of vitreous grains, often mixed with crystals, both microscopic, of an unequal volume, partially terreous, feebly adhering together or imperceptibly cemented by foreign substances (altered vitreous and semi-vitreous spodite).

ALLOITE.

Sub-types.

a alloïte (friable)
b ——— (consistent)
c ——— (indurated)

Syn. Part of the white or yellowish white tufas; pumice tufa, the pretended volcanic tripoli; the tripolean thermantides; agglutinated pumice ashes.

Type VI.

Composed of crystals often intermixed with vitreous grains, both microscopic, of a very unequal size, not inserted within each other; partly terreous; adhering very feebly or imperceptibly cemented by foreign substances (altered crystalliferous spodite).

TRASSOÏTE.

Sub-types.

a trassoïte (friable)
b ——— (consistent)
c ——— (indurated)

Synon. Tufas of an ashy gray; trass; part of the white or yellowish white tufas; the pretended volcanic tripoli.

Type VII.

Composed, exclusively, of microscopic crystals of an equal volume, interwoven, partly terreous, admitting at times greater or smaller vacuities between them, adhering by their simple juxta-

position, or imperceptibly cemented by foreign substances (altered Leucostine).

TÉPHRINE.

Sub-types.

a Téphrine (solid) *Syn.* Feldspathic lava, or decomposed petrosiliceous lava, decomposed klingstein, decomposed volcanic hornstein.

b ——— (friable) —- Decomposed domite, decomposed feld-spathic lava, basis of the porphyrtrappen.

c ——— (indurated) —- Basis of feldspathic amygdaloïde lavas, basis of the thonporphyry.

Type VIII.

Composed of massive or puffy glass slightly rent in various places, almost always with a mixture of microscopic crystals, more or less abundant, adhering by mere juxta-positi n, or imperceptiby cemented by foreign substances (altered obsidian and pumite).

ASCLÉRINE.

Sub-types.

a. Asclérine (solid) *Syn.* Decomposed heavy pumice stone; decomposed imperfect obsidian.

b. ——— (friable) —- Decomposed pumice stone, decomposed obsidian.

c. ——— (indurated) —- Pumice stone effervescing with acid or penetrated by hydrated iron.

Section II.

Pyroxenic substances ; *in which the particles of pyroxene are predominant.*

A) unaltered.

Type I.

Exclusively composed of microscopic crystals interwoven, of an

equal volume, adhering by their simple juxta position, leaving vacuities more or less considerable between them.

BASALT.

Sub-types.

a. Basalt (compact) *Syn.* Uniform basaltic lithoid lava; argillo-ferrugineous lava; trapp basalt; compact lava of Werner.

b. ——— (scaly) —— Scaly basaltic lava of Dolomieu, in which the crystals of feldspath are flat placed in the same direction.

c. ——— (granular) —— Gravelly basaltic lava of M. Faujas de St. Fond. Graustein of Werner?

Type II.

Composed of a puffy glass, with an almost constant mixture of microscopic crystals more or less abundant.

SCORIÆ.

Sub-types.

a. Scoriæ (grumous) *Synon.* A new sort, having the lithoid aspect, often confounded with the heavy scoriæ; porous lava of Werner?

b. ——— (heavy) —— Uniform scorified lava; heavy scoria of Dolomieu.

c. ——— (light) —— Uniform, scorified, or massive lava; thermantide cémentaire of Haüy; scoriæ of Werner; light scoriæ of Dolomieu.

Type III.

Composed of a massive glass, almost always with a mixture of microscopic crystals more or less abundant.

GALLINACE.

Sub-types.

a. Gallinace (perfect) *Synon.* A new sort; obsidian fusing

	into the black glass of Dedrée; glass with a basis of fontiform lava of Delamethérie.
b. Gallinace (smalloide) ——	A new sort, sometimes black, and sometimes of a dark red.
c. ——— (imperfect) ——	New sort forming the passage to the compact basalt.

Type IV.

Composed of crystals and microscopic grains not adhering.

CINERITE.

Sub-types.

a. Cinerite (crystalliferous)	*Syn.*	Ordinary volcanic ashes.
b. ——— (semivitreous)	——	Ditto.
c. ——— (vitreous)	——	Red volcanic ashes, or of a blackish gray colour.

B. altered.

Type V.

(*Same description as in Type V. of the First Section*) Cinerite vitreuse and semivitreuse altérées.

PEPERITE.

Sub-types.

a. Peperite (friable) *b*. ——— (consistent) *c*. ——— (indurated)	*Syn.*	Volcanic tufas of a vivid red; brown red; brown; intense grayish green; earthy pozzuolana partly friable; basis of some peperinos.

Type VI.

(*Same description as in Type VI. of Section the First*) Cinerite cristallifére altérée.

TUFAÏTE.

Sub-types.

a. Tufaïte (friable) *b*, ——— (consistent) *c*. ——— (indurated)	*Syn.*	Ordinary volcanic tufas; basis of most peperinos; friable pozzuolana; volcanic and trappean lava of Werner.

Type VII.

(*Same description as Type VII. of Section the First*) Basalte altéré.

WACKE.

Sub-types.		
a. Wacke (solid) *b.* ——— (friable) *c.* ——— (indurated)	*Synon.*	Decomposed basalt lava ; *Wacke* of Werner.

Type VIII.

(*Same description as Type VIII. of Section the First*) scorie, ou gallinace altérées.

POZZOLITE.

Sub-types.		
a. pozzolite (solid) *b.* ——— (friable) *c.* ——— (indurated)	*Syn.*	Decomposed scoriæ, capillary pozzuolanas, basis of the amygdaloïde scoriæ.

DECEMBER.

Art. I. *Suite du Mémoire sur les nouvelles Propriétés de la Chaleur à mesure qu'elle se développe, &c. Par M.* Brewster, *&c.*

(See Art. I. in Number for November.)

Art. II. *Recherches sur l'Action galvanique, par M.* Dessaignes.

The author had already shewn, by a series of experiments detailed in a memoir published in 1811 in the *Journal de Physique,* that a Voltaic pile lost entirely its electric power when exposed to a temperature + 100° (212° F)— while on the contrary its action became double in intensity, when half the pile only was exposed to the said temperature ; the other half remaining in the usual thermometrical state of the atmosphere. Similar results were also obtained when the whole, or only one-half, of the voltaic column was surrounded by a freezing mixture. He likewise shewed, that if two homogeneous metals were differently heated, and used to form a circle

with the limbs of a frog, muscular contractions were excited as when two dissimilar metals are employed.

M. Dessaignes now brings forward more facts in support of these results, some of which are curious: we can only find room for one or two. Heat a silver spoon throughout, and then cool it unequally, by placing one of its extremities on a mixture of ice and salt. Bring the nerves of a prepared frog in contact with the hottest, and the feet with the coolest end of the spoon: muscular contractions will be distinctly observed every time the experiment is made. Or lay hold of a prepared frog by its feet with one hand, and with the finger of the other, previously immersed in a frigoric mixture, touch the nerves of the animal; the same phenomenon of muscular contractions will be observed. Lastly, plunge the nerves of the frog in a bason full of cold and its feet in another of warm salt water; strong contractions will take place whenever we touch the water of the two vessels with the fingers of both hands at once. From these and many other interesting facts, M. Dessaignes concludes—1st. That by an even temperature, whether too high or too low, the metals lose their electromoving power. 2d. That by unequally heating an homogeneous body, the power of exerting muscular contractions in frogs, similar to that possessed by two heterogeneous bodies, is completely developed. 3d. That the electromoving power of a pair of plates, such as zinc and silver, may be entirely annihilated by heat and cold. 4th. And lastly, that when a voltaic pile is exposed to a uniform temperature of either —28° or 100° +, its electric power is destroyed.

The remaining Articles have been elsewhere noticed.

OCTOBER (*published December* 1816).

Art. I. *Notice de quelques Expériences et Vues nouvelles au Sujet de la Flamme. Par Sir* H. Davy.

(See Journal of the Institution, No. III. p. 124.)

Art. II. *Gas hydrogène arseniqué préparé d'une manière nouvelle, et dernières Expériences de M.* Gehlen *sur cet Objet.*

This note is taken from the papers left by the late M.

Gehlen, who fell a victim to the deleterious effects of the gas in question. He distilled 200 grains of arsenic with 600 grains of caustic potash, in order to observe the action of this substance on the metal. The gas which he obtained had no smell, and burned with a flame like that of hydrogene gas—being, in fact, as M. Gay Lussac properly observes in his observations on this paper, nothing but pure hydrogene gas, and not arsenicated hydrogeue gas. The residue in the retort is spungy and bulky, of a reddish brown in its inferior, and blackish in its superior part. It attracts quickly the humidity of the air, and when water is thrown over it, it dissolves quickly, becomes heated, and a gas having the smell of garlic is given out. The decomposition of water takes place likewise, when instead of arsenic we employ its oxide with caustic potash nearly dessicated, and at a high temperature. There is then, as in the former instance, a considerable disengagement of hydrogen gas; and the result of this decomposition is an arseniate of potash, which may also be obtained by heating together the oxide of arsenic and carbonate of potash, fused and deprived of water. In this case the carbonic acid is given out, and one portion of the oxide is reduced to acidify the other.

The reddish brown mass observed by Gehlen in his experiments is, according to M. Gay Lussac's opinion, a mixture of arsenite and arseniuret of potash. It is not likely that any arseniate should be present; or when the oxide of arsenic acts upon potash or its carbonate, an arseniate should be formed. The arseniuret, like the alcaline phosphurets, decomposes water, and produces arseniuretted hydrogene gas. We cannot give, in the small space to which our extracts of the different articles must be confined, all the valuable observations with which M. Gay Lussac has illustrated the above short memorandum of the late M. Gehlen.

Art. III. *Suite des Récherches de M. Berzelius, &c.*

This continuation of Berzelius's memoir, of which we had occasion to speak in another part of our Journal, contains the properties of tantalum; its degrees of oxidation; its capacity

of saturation, and its chemical properties. In a fourth article we have the analysis of several minerals containing tantalum. And a fifth gives us the analysis of all the tungstates hitherto known.

Art. IV. *Sur l'Action reciproque des Pendules, et sur la Vitesse du Son dans les diverses Substances, par* M. Laplace.

We have mentioned the first part of this interesting paper in our account of the proceedings of the Royal Academy of Sciences at Paris, inserted in our present Number; and the algebraic developement of the second part, by M. Poisson, in our review of the Bulletin de la Société Philomathique, for December, 1816.

Art. V. *Aux Redacteurs des Annales de Chimie et de Physique.* Lettre de M. T. de Saussure.

This is an answer to the objections made by Gay Lussac to M. Saussure's observations on the variation of carbonic acid gas in the atmosphere. Attached to it is a reply from Gay Lussac. But having thus announced the subject of difference between these two eminent chemists, our readers cannot expect us to go any further, "*tantos animos non est componere nobis.*"

Art. VI. *The Description of a new Steam Engine by* M. Bouvier, *illustrated by a Plate.*

He thinks that the best machine of this kind would be one which should unite the advantages of a high pressure; the augmentation of force derived from the dilatation of vapour; and the simplicity resulting from the immediate production of the required movement in the apparatus. He offers the project of such a machine to the consideration of the mechanist; without presuming to say that he has completely succeeded in obtaining the object he had in view.

Art. VII. *Extrait des Séances de l'Academie Royale des Sciences, &c.*

(See our account in the present Number.)

Art. VIII. *Sur la Hauteur, la Vitesse, la Direction, et la Grandeur du Météore qui tomba pres de Weston dans le Connecticut,* 14*th December,* 1807.

Those who wish to become acquainted with the fact which forms the subject of the present article, will find it detailed at full length in the Transactions of the American Society of Arts and Sciences, Vol. III. Part II. where it was inserted by the author, M. Bowditch, in 1815.

Art. IX. *Sur l'Acier.*

Art. X. and XI. *On Flame by Mr. Sym; and on the galvanic Action in Asthmas by Dr.* Wilson, *of* Worcester.

Art. XII. is an extract from Schweiger's Journal, and relates to the difference noticed by Professor Doebereiner between animal and vegetable charcoal.

Art. XIII. announces the publication of the *Geography of Insects, by* M. Latreille.

Annales de Chimie et de Physique redigée, par MM. Gay Lussac *and* Arago.

NOVEMBER (*published January* 1817).

Art. I. *Instructions concernant les Préparations nommées Lac-lake et Lac-dye, &c. Translated from the English.*

This is taken from Dr. Bancroft's work on Colours.

Art. II. *Mémoire sur le Rapport de la Mesure appelée Pouce de Fontainier avec l'Once d'Eau romaine modern, &c. par M.* De Prony.

This paper, although full of interest, is not of a nature to be abridged, so as to prove of any advantage to our readers. It appears from this memoir that a family composed of ten individuals at Paris, consumes about 70 litres (140 lbs. +) of water; being 14 pounds of water for each person. Changing this number for one more likely to be correct, 20 lbs., M. Prony states, that the inch of water would

be equal to the produce of 20 cubic metres of that fluid, given out in four and twenty hours; and in order to find the size and figure of the orifice through which that quantity of water ought to pass in a given time, as well as the central charge and the length of the tube (*ajutage*) the author has described a highly ingenious apparatus, by means of which several very curious and illustrative experiments have been performed. The unity being thus found, he proposes it should be added to the present decimal system in France, under the denomination of *Module d'Eau.*

Art. III. *Extraits des Journaux étrangers et nationaux.*

Art. IV. *Sur la Propriété qu' a le Tartrate acide de Potasse de dissoudre un grand Nombre d'Oxides, par* M. Gay Lussac.

The fact thus announced, says the author, is known to most chemists; but sufficient attention has not been paid to this property of tartar. From the different facts observed in this case, M. Gay Lussac is inclined to consider the super tartrate of potash as acting like a simple acid; and what gives more plausibility to this mode of considering the salt in question, is this; that it dissolves a great number of oxides, even when these are insoluble in the mineral acids and the tartaric acid. Hence a new difficulty of defining acurately the properties, acidity, and alcalinity; for if we are to consider as alcalis, all bodies saturating super tartrate of potash in the same manner, it is certain that the oxides of antimony and tin, which saturate the super tartrate of potash, ought to be considered as alkalis. The tartaric acid, and the acid tartrates, present several strong analogies with the hydrocyanic acid and the hydrocyanates, in the property they have of combining more intimately by means of complex affinities. M. G. Lussac concludes with observing that the supertartrate in question, is the best known solvent of the oxides, and that it is, therefore, particularly useful in analyses.

Art. V. *Mémoire sur les Substance minerales dites* en masse, *&c. par* M. Cordier.

(See our last and present Number.)

Art. VI. *A Description of Captain Kater's new-invented Compass.*

Art. VII. *Relates to some difference of opinion between the two professors* Meinecke *and* Doebereiner, *and* M. Gay Lussac, *on the subject of the produce of vinous fermentation.* The attack made on the latter does not seem to deserve much attention.

Art. VIII. *Sur l'Elévation des Montagnes de l'Inde, par* Alexandre de Humboldt.

This is a well digested and admirably arranged compilation of all the most authentic documents, and other information respecting the elevation of the mountains of the great Indian Continent. There are some comparative observations in it on some European and the highest American ridges, so well examined by this indefatigable and eminent naturalist; and it concludes with a translation of the brief account we gave in our last Number, of the measurements of the Himalaya, taken from the 12th volume of the Asiatic Researches.

Art. IX. *Extrait des Séances de l'Academie Royale des Sciences*

(See our account in this Number.)

Art. X. XI. XII. XIII. and XIV. relate to some extracts from foreign journals, chiefly English.

DECEMBER.

(Published the 26th February, 1817.)

Art. I. *Analyse du Seigle ergoté du Bois de Boulogne près Paris, par* M. Vauquelin.

We were fortunately enabled to anticipate the editors of the Annales, in the publication of these experiments, through the kindness and liberality of their eminent author.

Art. II. *Théorie de la Chaleur, par* M. Fourier.

As the author is about to publish the great work from

which the present has been extracted; and as we shall perhaps have occasion to lay an account of it before our readers, we for the present pass over in silence this article, observing only that, from what we know of the work and the author, we promise ourselves much information as well as gratification, in the perusal of the production we announce, and which will consist of a volume in quarto, of 650 pages. To have submitted all the laws and phenomena of heat to the test of calculation, must have required considerable time and intense application.

Art. III. *Note contenant quelques Expériences relatives à l'Action de l'Acide hydrochlorique* (mur. acid) *sur les Alliages d'Etain et d'Antimoine, par* M. Chaudet, *Essayeur des Monnaies.*

The unequal action of muriatic acid on tin and antimony, has long ago been observed, and proposed as an analytical means by the experimental chemist. Mons Thenard went as far as any other on this subject, if we may judge from his observations on the combination of antimony with tin, inserted in the Annales de Chimie; but that chemist found on experiment, that when an alloy of the two metals was treated with muriatic acid, the action was extremely weak, and antimony as well as tin, was dissolved. Nor has he been able since to obtain the complete separation of the two metals by that method. Yet the solution of the problem presents a peculiar degree of interest to the analytical chemist, as the alloy in question, is become very generally useful in the arts, and is often met with. These were the reasons which led the present author to undertake the experiments detailed in this paper. It results from these, that the best mode of operation, when it is wished to assay an alloy of tin and antimony, will be the following. First ascertain whether the alloy contains lead, which may be easily done by treating a portion of it with nitric acid, and precipitate the lead (if any be present) by sulphuric acid. Next determine the quantity of antimony contained in the alloy, which may be done on a small scale, by taking five parts of the alloy, combining them with 100 parts of tin, and after laminating the whole very fine, treating it with

hydrochloric acid (*muriatic*) by means of heat. The undissolved portion indicates, with very little difference, the quantity of antimony present. This information once obtained, take 100 parts of the alloy in question ; add with all due precaution, and in a crucible under charcoal, as much tin as will suffice to render the whole quantity of it to the proportion of antimony present as 20.1. This new combination being made, flatten it and laminate it very fine, cut it into small pieces, introduce it into a matras with an excess of muriatic acid, at 22° of the aerometer of Beaumé, and after two hours and half of ebullition at least, collect on a filtre the insoluble part, which represents the antimony contained in the alloy.

Art. IV. *Nouvelles Expériences sur le Developpement des Forces polarisantes, &c. par* M. Biot.

(See our account of the proceedings of the Royal Academy of Sciences at Paris, for January last.

Art. V. *Analyse des Sels de Strontiane et de quelques Mineraux, par* M. Stromeyer.

The present paper, taken from the Literary Advertiser of Göttingen, is a valuable addition to analytical chemistry. The first object of Professor Stromeyer, was that of finding the exact composition of the carbonate of strontian, as he intended to determine by it the composition of the other salts, by finding out the quantity of any acid necessary to decompose any given weight of the carbonate. His experiments gave for elements of the latter salt,

Strontian - -	70,313 or	100,00
Carb. acid - -	29,687	42,22
	100,000	142,22

The carbonates of strontian, whether natural or artificial, do not contain any water of crystallization, as Dr. Hope and Pelletier suspected.

If we assume 10 to be the equivalent number for oxygen, we have the following numbers for the equivalent of

Carbonate of strontian	- -	92,768
Strontian	- - - -	65,228
Strontium	- - - -	55,228

Strontian therefore, is composed of

Strontium	- -	84,669 or	100,000
Oxygene	- -	15,331	18,107
		100,000	118,107

The sulphate of strontian consists of

Strontian	- -	57,0 or	100,00
Sulphuric acid	- -	43,0	75,44
		100,0	175,44

The nitrate of strontian is composed of

Strontian	- -	49,38 or	100,00
Nitric acid	- -	50,62	102,51
		100,00	202,51

The muriate of strontian contains

Strontian	- -	65,585 or	100,000
Muriatic acid	-	34,415	52,474
		100,000	152,474

The phosphate contains

Strontian	- -	63,435	100,00
Phosphoric acid	-	36,565	57,64
		100,000	157,64

The remainder of this article relates to the analyses of two new substances, the result of which has been given by Dr. Thomson, in his Annals of Philosophy for March.

Art. VI. *Examen de la Methode pour dépurer la Magnésie de la Chaux, au moyen du Carbonate neutre de Potasse, par le Professeur* Bucholz.

It having been remarked, that the carbonate of lime is like the carbonate of magnesia, soluble in an excess of its acid,

Professor Bucholz began to doubt of the accuracy of the method hitherto employed for separating these two substances. This gave rise to some new experiments, which are detailed in the present paper, and from which it results, that the process followed by most chemists, for separating the lime from magnesia, by means of a neutral carbonate of potash is correct, since a portion of the carbonate of lime remains in solution with the carbonate of magnesia. M. Doebereiner then suggests the sub-carbonate of ammonia as the best reagent in such cases. The carbonate of lime is precipitated, and the magnesia remains in solution, forming a triple combination with ammonia, from which the earth may be easily separated by ebullition.* The two earths may also be separated by precipitating them in the first instance, by means of the sub-carbonate of potash or of soda, and by boiling the precipitate with a solution of muriate of ammonia. The carbonate of magnesia dissolves entirely while that of lime remains unaltered. During the operation, some carbonate of ammonia is evaporated, which may be collected, and being saturated with an acid of a known strength, may serve to determine the proportion of magnesia to that of lime in the substance analysed.

Art. VII. and VIII. from Thomson's Annals.

(Taken from the Annals of Philosophy, Number XLVI.)

Art. IX. *A MM. Gay Lussac et Arago, Redacteurs des Annales de Chimie et de Physique. Lettre de M. Majendie.*

"Il y a des inconvéniens à toutes choses, même à *avoir raison* dans une discussion scientifique," says M. Majendie, who we are sorry to see so much out of humour with the remarks we were induced to make upon some of his experiments in a former Number of this Journal. If we pursue the discussion, we fear

* We can assure Professor Dobereiner, that M. Vauquelin, has been in the habit of recommending the same process for many years, in his public courses of chemistry.

it may become personal, and therefore waive it altogether. We took up the question solely upon scientific grounds, and as M. Majendie promises to satisfy our desire to see new experiments upon the very important subject of his paper, our end is quite answered. Whether M. M. *avait raison* is a question, the decision of which we leave to the readers of his paper, and our criticism.

Art. X. *Extraits des Journaux.*

(See our analytical review in this Number for the month of December, of the Journal de Physique.)

Art. XI. *Extrait des Séances de l'Academie Royale des Sciences en Decembre,* 1816.

(See our account of the Proceedings of the Royal Academy in the present Number.)

Art. XII. *Resumé des Observations météorologiques de l'Année* 1816.

This is an important article, and one which may prove of much valuable comparative interest. It appears, that there have been at Paris in 1816, 167 days of rain, 26 in July only; 71 days of frost, and 13 with snow. In nine months hail fell 19 times. Ten thunder storms were observed. The wind has blown 12 days from the N., 51 from the N. E., 24 from the E., 24 from the S. E., 52 from the S., 83 from the S. W. 84 from the W., 36 from the N. W. On the 12th of October, at 3 P.M. the magnetic needle had a west declination of 22° 25′. On the 6th of the same month, at noon, the inclination measured with a needle, the poles of which had been turned to compensate the defects of equilibrium, was 68° 40′.

Bulletins de la Société Philomathique de Paris.

Art. I. *Continuation of* M. Blainville's *Account of the Hottentot Venus.*

Art. II. *Sur la Transmission du Son à travers des Corps solides, par* M. Laplace.

This paper does not admit of abridgment.

Art. IV. *Fusion des Substances reputées infusibles, &c. By Dr.* Clarke.

(See Journal of the Institution, No. III.)

Art. V. *Aperçu des Genres nouveaux formés, par M.* Henry Cassini, *dans la Famille des Synanthérées.*

We have given an account of the formation of this new family, established by the above botanist, in a preceding Number of this Journal, and shall wait to say more about it, till the publication of his work called *Synantherologie,* which he is about to publish.

Art. VI. *Expériences sur la Flamme, par* M. B. Syms.

(See Annals of Philosophy, November, 1816.)

Art. VII. *Mémoire de Géometrie aux trois Dimensions, par M.* Hachette.

We have here the exposition of a new theory for the geometrical construction of a tangent to a curve in a given point; of the radius of curvature to the same point, and of the osculating plane when the curve has a double curvature.

Journal de Pharmacie et des Sciences Accessoires, par MM. Cadet, Planche, Pelletier, Virey, &c.

NOVEMBER.

Art. I. *Observations sur la Préparation de l'Ether sulphurique, et sur les Résidus de cette Opération, par M.* Deslauriers.

In this paper there is nothing very new or interesting.

Art. II. *Sur la Manière de préparer les Eaux minérales artificielles et les Carbonates, par M.* Gehlen.

This paper contains a description of the great establishment for the preparation of aërated mineral water, and the carbonates, now existing at Vienna, where M. Gehlen saw it. It is conducted by Dr. Fierlinger, who gave the writer of the present article permission to publish an account of it in the scientific journals of Germany. The carbonic acid necessary for the different purposes of this establishment is obtained

from the fermentation of certain substances, which are renewed every morning. The gas is given out in the greatest abundance after about an hour, and continues so the whole day. The residue of the fermented liquor is then distilled, and an excellent *eau de vie* obtained. The fermenting materials consist in a finely ground portion of oats and malt, with which a *mash* is made. The mode of saturating the water with the carbonic acid thus obtained, is very simple. The gas having been received in ordinary bottles, they are slightly corked, and placed with their mouths downwards, in different ranges, in a large but, where they are kept steady by appropriate means; solution of sub-carbonate of soda, or of other salts, is then poured into the but, and the apparatus is then left for one night and a day in a cold place. The solution, by its elevation over the bottles, exerts a degree of pressure which forces part of the liquid into the bottle through the cork slightly introduced, where it absorbs the gas and fills the bottle. The next day, all the bottles which have not been completely filled by the solution, receive the necessary addition for that purpose, with artificial mineral water already prepared, and are then quickly and perfectly corked.*

Art. III. *Suite des Mémoires de M. Chevreul sur la Saponification.*

(See our preceding Number.)

Art. IV. *Accident causé par l'Angustura, extrait d'une Note addressée à M. Planche, par le Docteur* Marc.

We have here another instance of the bad effects of the false angustura, so ably described in a paper inserted in one of the Numbers of the London Medical Repository of last year. M. Marc having taken, as he thought, a small quantity of an infusion of the true angustura, was attacked with all the alarming symptoms of a complete *trismus*; and but for the dose of laudanum in acetic acid, which he immediately took, and which relieved him instantly, would have, perhaps, fallen a victim to the poisonous qualities of the bark.

* This way of proceeding would not satisfy the London soda water makers.

Art. V. *Examen d'une nouvelle Espéce de Quinquina, par M.* Cadet.

The Governor of Martinique sent a quantity of bark to Dr. Alibert, which has been considered as belonging to a tree of the family of the cinchona. But the description of the tree itself being wanting, it is difficult to say whether that conjecture be just or not. The specimens examined by M. Cadet did not seem to have all come from the same tree; but they were all analysed separately, and the purport of the present note is to give the result of those analyses. M. Cadet is inclined to suspect it to be a false angustura; and though he be not in a condition to affirm positively the fact, still he recommends practitioners to be on their guard in the employment of this new substance.

Art. VI. and VII. require no comment.

Art. VIII. and IX. relate to a letter from Rio Janeiro containing some articles of information on various subjects of natural history and the manufacturies of that country. A second letter gives an account of the mode of roasting cocoa in Spain.

A letter from M. Thevenin to the Editors, and their answer to it, concludes this Number. This correspondence relates to a squabble about the composition and solubility of cream of tartar, and the mode of action of boric acid on that salt.

DECEMBER, 1816.

Art. I. *Histoire naturelle et medicale de la Noix de Serpent, ou Nhandiroba, et Considérations générales sur la Famille des Cucurbitacées.*

This article is not susceptible of abridgement.

Art. II. *Recherches chirurgiques sur le Pseudo-Narcissus de L. par M.* Caventon.

The author recommends this plant to the attention of the dyers, as capable of furnishing a very fine yellow colour applicable, with ease, to silk, linen, and wool.

Art. III. *Suite de l'Extrait des Mémoires de M. Chevreul sur les Corps gras.*

(See our preceding Numbers.)

Art. IV. *Essai sur les Moyens d'extraire le plus de Principes solubles des Substances abondantes en Fecule amilacée, &c. par M.* Bertrand.

The process employed by this *pharmacien*, for making extracts, is the following: bruise the plant, root, or bark by proper means, put the coarsely pulverised produce into a strong metallic sieve, which is then plunged into distilled water. Agitate from time to time, the matter, so as to facilitate the extraction of all the soluble principles, and the precipitation of the feculæ, or resins, through the sieve. After this operation, which lasts twenty-four hours in winter, and twelve in summer, wash, by means of a watering pot, the remainder, and submit it to the action of a press. All the liquids are then collected together, and decanted by the usual method. These are next evaporated on a sand bath, in distilling vessels, and the extract obtained of a requisite consistency.

We must here conclude our extracts from this Number, which does not furnish any other article of information likely to interest the generality of our readers.

ART. XVII. METEOROLOGICAL DIARY for the Months of December, 1816, and January and February, 1817, kept at EARL SPENCER's Seat at Althorp, in Northamptonshire. The Thermometer hangs in a north-eastern aspect, about five feet from the ground, and a foot from the wall.

METEOROLOGICAL DIARY for December, 1816.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Sunday	1	32	36	30,56	30,49	NW	W
Monday	2	26	38	30,35	30,30	WSW	WNW
Tuesday	3	29	40	30,30	30,30	W	ESE
Wednesday	4	35	39,5	30,30	30,23	SE	ESE
Thursday	5	38	41	29,99	29,55	ESE	SE
Friday	6	36	39	29,45	29,42	WbS	SE
Saturday	7	32,5	36	29,39	29,48	W	WSW
Sunday	8	27,5	36	29,46	29,58	W	W
Monday	9	25	41	29,54	29,41	SE	SSE
Tuesday	10	34	43	29,50	29,11	W	WSW
Wednesday	11	35	38	29,13	29,25	WbS	WbS
Thursday	12	30	37	29,30	28,68	SW	E
Friday	13	35	37	28,90	29,04	W	WSW
Saturday	14	30	35	29,20	29,20	W	SE
Sunday	15	35	39	28,77	29,00	WSW	W
Monday	16	30	37,5	29,30	29,40	WSW	W
Tuesday	17	33	46,5	29,30	29,20	SE	WSW
Wednesday	18	33	41	29,27	29,60	WbS	NE
Thursday	19	32,5	35	30,12	30,24	NbE	N
Friday	20	21	32	30,42	30,43	NW	NNE
Saturday	21	16	29	30,33	30,11	SW	ESE
Sunday	22	13	29,5	29,99	30,04	ESE	WNW
Monday	23	20	42	29,86	29,71	WSW	SW
Tuesday	24	42	47	29,54	29,45	SW	WbS
Wednesday	25	30	39	29,68	2[illegible],64	W	SW
Thursday	26	35	49,5	29,24	3[illegible],30	WbS	W
Friday	27	32	39,5	29,33	29,38	WbS	WbS
Saturday	28	27	45	29,07	29,35	WbS	S
Sunday	29	37	42,5	29,35	29,75	W	W
Monday	30	31	36	29,89	29,70	E	ESE
Tuesday	31	36	46	29,62	29,60	ESE	SSE

METEOROLOGICAL DIARY

for January, 1817.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Wednesday	1	38	47	29,44	29,30	S	S
Thursday	2	38	42,5	29,30	29,43	SW	SSW
Friday	3	32	40	29,43	29,55	SSW	WSW
Saturday	4	35	53	29,09	29,09	SSW	WSW
Sunday	5	36	41	29,69	29,60	W	W
Monday	6	33	42	29,44	29,74	W	NW
Tuesday	7	32	36	30,27	30,32	W	W
Wednesday	8	26	33	30,35	30,35	ESE	S
Thursday	9	24	33	30,44	30,49	SSE	SE
Friday	10	23	31	30,49	30,44	SW	WSW
Saturday	11	25	37,5	30,37	30,28	WSW	WbS
Sunday	12	31	38	30,09	30,00	W	WbN
Monday	13	29	37	29,70	29,49	WbS	SW
Tuesday	14	32	36	29,47	29,50	W	W
Wednesday	15	27,5	31	28,92	29,10	E	WNW
Thursday	16	16	37	29,23	28,84	SSE	SE
Friday	17	30	40	28,79	28,79	SSE	S
Saturday	18	34	42	28,98	29,00	SbW	SSE
Sunday	19	35	40	29,00	28,80	SE	ESE
Monday	20	39	47	28,70	28,70	S	WSW
Tuesday	21	28	37	29,30	29,61	W	WbS
Wednesday	22	31	49	29,52	29,67	SW	S
Thursday	23	42	52	29,70	29,65	SW	SW
Friday	24	36	48	30,00	30,08	WbN	SW
Saturday	25	48	51	30,13	30,13	SW	SW
Sunday	26	44	46	30,08	30,00	SW	SW
Monday	27	43	45	30,16	30,29	WbN	EbN
Tuesday	28	29	40	30,30	30,20	NE	NE
Wednesday	29	39	46	30,15	30,20	WbS	W
Thursday	30	39	48	30,20	30,20	W	WNW
Friday	31	41	44	30,29	30,31	NW	W

METEOROLOGICAL DIARY

for February, 1817.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Saturday	1	37	46	30,40	30,40	WbN	W
Sunday	2	36,5	44	30,40	30,30	NW	WNW
Monday	3	35	40	30,24	30,14	W	SW
Tuesday	4	38	45	29,88	29,55	SW	SW
Wednesday	5	35	42	29,55	29,76	W	W
Thursday	6	39	51	29,80	29,84	W	WbS
Friday	7	43	50	29,92	30,03	W	W
Saturday	8	42	48	30,08	30,03	W	W
Sunday	9	40	47	30,18	30,18	W	W
Monday	10	40	49	30,00	29,89	W	SW
Tuesday	11	33	37	29,76	29,93	NE	W
Wednesday	12	29	44	29,34	29,60	W	WNW
Thursday	13	31	50	29,70	29,59	SSE	W
Friday	14	39	42	29,39	29,60	W	W
Saturday	15	36	47	29,38	29,38	SW	W
Sunday	16	35	43	29,56	29,74	W	WbS
Monday	17	35	53	29,80	29,84	WbS	W
Tuesday	18	36	53	29,90	29,78	W	SW
Wednesday	19	32,5	54	30,03	29,06	W	SE
Thursday	20	37	51	26,69	30,30	SW	S
Friday	21	33	43	29,36	29,30	SW	W
Saturday	22	34	44,5	29,46	29,68	W	WNW
Sunday	23	36	48,5	29,80	29,56	WbS	SW
Monday	24	39	39	29,60	29,79	W	W
Tuesday	25	40	52	29,84	29,78	W	W
Wednesday	26	40	45	29,55	29,65	W	W
Thursday	27	42	47	29,40	29,60	W	WNW
Friday	28	40	52	29,70	29,70	WbS	W

LIST OF THE MEMBERS
OF
THE ROYAL INSTITUTION.
1816.

His Sacred Majesty King GEORGE III. Patron.

HONORARY MEMBERS.

His Royal Highness GEORGE Prince Regent.

His Royal Highness ADOLPHUS FREDERICK, Duke of Cambridge.

His Majesty MAXIMILIAN, King of BAVARIA.

His Imperial Highness, the Grand Duke NICHOLAS of Russia.

His Excellency the Prince of CASTELCICALA, Minister Plenipotentiory of His Sicilian Majesty, &c. &c. &c. &c.

MARC AUGUSTE PICTET, Professor of Natural Philosophy at Geneva.

Rev. ADRIEN QUINTIN BUEÉ, of Paris.

Professor MORICHINI, of the College of Sapienze of Rome.

Professor KLAPROTH, of Berlin.

Le CONSEILLER DE LA RIVE, of Geneva.

Il PADRE MONTICELLI, of Naples.

M. DE SAUSSURE, of Geneva.

Il CAVALIER SEMENTINI, Professor of Chemistry of Naples.

Il CONTE J. G. BARDE, Director of the Museum at Florence.

Le BARON JACQUIN, of Vienna.

Monsieur CUVIER, F. R. S. and Sec. Royal Inst. of France.

Professor DECANDOLLE, of Geneva.

Professor VAUQUELIN, of Paris.

Il CONTE VOLTA, of Como.

Baron LEOPOLD VON BUCH, of Berlin, Chamberlain to His Majesty the King of Prussia.

Professor JENS ESMARK, of Christiania.

Professor VIVIANI, of Genoa.

President, Earl SPENCER, K. G. F. R. S. and F. A. S.
Treasurer, Scrope Bernard Morland, Esq. M. P. LL. D.
Secretary, Thomas Harrison, Esq. A. M. F. R. S.

MANAGERS.

Marquis of LANSDOWNE, LL.D. F. R. S. V. P.
Earl of WINCHILSEA and NOTTINGHAM, K. G. F. R. S. &c. V. P.
Earl of MORTON, K. T. F. R. S. and F. A. S. V. P.
Right Hon. Sir John Nicholl, M. P. LL.D. F. R. S. and F. A. S. V. P.
Sir J. Cox Hippisley, Bart. M. P. LL. D. F. R. S.
James Peter Auriol, Esq. F. R. S. V. P.
John Frederick Daniell, Esq. F. R. S.
Sir Humphry Davy, LL. D. F. R. S. &c. &c. V. P.
George Duckett, Esq. F. R. S. and F. A. S.
Charles Hatchett, Esq. F. R. S. and F. A. S.
Daniel Moore, Esq. F. R. S. F. A. S. and F. L. S.
John Sanders, Esq. F. A. S.
Thomas Snodgrass, Esq.
Samuel Solly, Esq. F. R. S.
William Watson, Esq. F. R. S.

VISITORS.

Duke of SOMERSET, F. R. S.
Marquis of STAFFORD, K. G.
Earl of DARNLEY, F. R. S.
Lord HOLLAND, F. R. S.
Sir John Thomas Stanley, Bart. F. R. S. and F. A. S.
George Aust, Esq. F. R. S. and F. A. S,
Rev. Charles Burney, D. D. F. R. S. and F. A. S.
William Hasledine Pepys, Esq. F. R. S.
Sir Christopher Hawkins, Bart.
Gibbes Walker Jordan, Esq. A. M. F. R. S.
William Morgan, Esq. F. R. S.
Charles Pieschell, Esq.
Peter Mark Roget, M. D. F. R. S.
Richard Horsman Solly, Esq. A. M. F. R. S. and F. A. S.
Lieut. General William Thornton, M. P.

Members with a ⊙ before their Names, have subscribed to the Benefaction Fund of the Institution.

T before the Name of a Member, denotes that he has purchased one or more transferable Tickets for the Lectures.

Lord Ashburton
Col. Alexander Allan, M. P.
⊙ William Allen, Esq.
⊙ John Julius Angerstein, Esq.
⊙ Sir Edmund Antrobus, Bart.
⊙ Alexander Apsley, Esq.
Samuel James Arnold, Esq.
William Atkinson, Esq.
⊙ James Peter Auriol, Esq. F. R. S.
⊙ George Aust, Esq. F.R.S. and F.A.S.
William Ayrton, Esq.

Duke of Bedford, F. A. S.
⊙ Earl of Bessborough.
Earl of Breadalbane, F. R S.
⊙ Earl of Bridgwater, F.R.S.&F.A.S.
Viscount Bulkeley.
Lord Braybrooke, F. A. S.
Earl Brownlow, F. R. S. and F. A. S.
Right Hon. Sir Joseph Banks, Bart. G. C. B. P. R. S. and F. A. S.
Hon. Bartholomew Bouverie, M. P.
⊙ Sir Thomas Bernard, Bart. LL. D.
⊙ Sir Charles William Rous Boughton, Bart. F. R. S.
Sir Richard Brooke de Capell Brooke, Bart. F. R. S.
Sir Frederick Baker, Bart. F. R. S.
⊙ Sir Gilbert Blane, Bart. M.D. F.R.S.
Sir Samuel Bentham.
William Babington, M. D. F. R. S.
⊙ John Baker, Esq. F.R.S. and F.L.S.
William Baker, Jun. Esq.
John Balfour, Esq.
Rev. John Banks, B. D. F. A. S.
⊙ Charles Baratty, Esq. F. A. S.
⊙ Robert Barclay, Esq. F. L. S.
⊙ Richard Barker, Esq.
⊙ George Basevi, Esq.
⊙ John Bate, Esq.
⊙ Robert Batty, M. D. F. L. S.
Mrs. Beaumont.
Charles Beazley, Esq. F. A. S.
Thomas Tyringham Bernard, Esq.
⊙ Robert Bingley, Esq. F. R. S.
William Henry Blaauw, Esq.
⊙ William Blake, Esq. A. M. F. R. S.
⊙ Ralph Blegborough, M. D.
⊙ Samuel Boddington, Esq.
Thomas Boddington, Esq.
⊙ Matthew Robinson Boulton, Esq.
Charles Henry Bouverie, Esq.
Joseph Bradney, Esq.
William Thomas Brande, Esq. *Sec.* R. S. *Lond.* F. R. S. *Edin.* *Prof. Chem.*
Timothy Brent, Esq.
William Bridgman, Esq. F. L. S.
⊙ Charles Broderip, Esq.
⊙ Benjamin Collins Brodie, Esq. F. R. S.
James Brogden, Esq. M. P.
Patrick Crauford Bruce, Esq.
William Bruere, Esq.
Alexander P. Buchan, M. D. F. L. S.
Rowland Burdon, Esq.
⊙ Rev. Charles Burney, D.D. F.R.S. and F. A. S.
⊙ Rev. Charles Parr Burney, A. M.
Sir William Burroughs, Bart.
William Bushby, Esq.
William Busk, Esq.
John Buller, Esq. F. A. S.
Charles Butler, Esq. F. A. S.
John Buxton, Esq.

Earl of Chichester, F. R. S.
Earl Cowper.
Lord Bishop of Clogher, F. A. S.
⊙ Lord Carrington, F. R. S.
Lord George Augustus Henry Cavendish, M. P.

⊙ Hon. Hugh Clifford.
⊙ Right Hon. Reginald Pole Carew, M.P. F. R. S. and F. A. S.
Sir Thomas Clarges, Bart.
Sir Simon Haughton Clark, Bart.
Henry Thomas Colebrooke, Esq.
⊙ Sir Nathaniel Conant.
⊙ John Hutton Cooper, Esq. F. A. S.
Richard Clark, Esq. *Chamberlain of London*, F. A. S.
⊙ Benjamin Bond Cabbell, Esq.
⊙ Thomas Calverly, Esq.
Thomas William Carr, Esq.
Samuel Castell, Esq.
John Chamier, Esq.
Mrs. Elizabeth Chaplin.
Richard Chenevix, Esq. F. R. S.
⊙ Charles Madryll Cheere, Esq.
⊙ Thomas Chevalier, Esq.
John George Children, Esq. F. R. S. and F. L. S.
⊙ Langham Christie, Esq.
Samuel Pepys Cockerell, Esq.
Richard Collins, Esq.
⊙ Thomas Collins, Esq.
Oliver Colt, Esq.
Henry Cooke, Esq.
⊙ Thomas Coutts, Esq.
Samuel Crompton, Esq
⊙ James Curry, M. D. F. A. S.

⊙ Duke of Devonshire.
⊙ Earl of Darnley, F. R. S.
Earl Digby.
⊙ The Honourable the Lord Bishop of Durham.
⊙ Lord Dundas, F. R. S. and F. A. S.
⊙ Sir John Brewer Davis.
T ⊙ Sir Humphry Davy, LL.D. F.R.S. *Lond.* and *Edin.* M. R. I. A. *Hon. Prof. Chem.* R. I.
Sir George William Denys, Bart. M. P.
William Dance, Esq.
Henry Dance, Esq.
George Dance, Esq.
John Frederick Daniell, Esq. F. R. S.
Edward Robert Daniell, Esq.
Alexander Davison, Esq.
⊙ Richard Davenport, Esq.
⊙ Thomas Davy, Esq.
William Dawson, Esq.
Thomas Day, Esq.
John Dearman, Esq.
Richard Debaufre, Esq.
Miss Dehany.
Joseph Delafield, junior, Esq.
⊙ Charles Dickenson, Esq. F.R.S. and F. A. S.
Thomas Dimsdale, Esq.
John Dingwall, Esq.
⊙ John Disney, Esq. F. H. S.
Capt. Francis Drummond.
James Drummond, Esq.
Richard Duppa, Esq. LL.B. and F. A. S.
James Du Pré, Esq.
T ⊙ G. Duckett, Esq. F.R.S. and F.A.S.

Marquis of Exeter.
⊙ Earl of Egremont, F.R.S. & F.A.S.
Lord Erskine, F. R. S.
Sir Henry C. Englefield, Bart. F. R. S. *Lond.* and *Edin.* V. P. S. A.
Sir John Eamer.
⊙ Hugh Edwards, Esq.
John Ellis, Esq. F. L. S.
John Esdaile, Esq.

Major-General the Hon. T. W. Fermor, F. R. S. and F. A. S.
James Peter Fallofield, Esq.
Farrar Grove Spurgeon Farrar, Esq.
John Nicholas Fazakerley, Esq. M. P.
Nathaniel Fenn, Esq. F. R. S.
Robert Ferguson, Esq. F. R. S.
Edward Fletcher, Esq.
⊙ Rev. Edward Forster, A.M. F.R.S. and F. A. S.
⊙ John Forster, Esq.
James Franck, M. D.
James Fraser, Esq.
⊙ Francis Freeling, Esq. F. A. S.
⊙ John Fuller, Esq.

Earl Grosvenor.
⊙ Lord Grenville, *Canc. Univ. Oxon.*
Mrs. Gautier.

⊙ Davies Giddy, Esq. M. P. F. R. S. and F. L. S.
Peter Giles, Esq.
⊙ Daniel Giles, Esq.
Philip Lake Godsal, Esq.
⊙ GeorgeTrenchard Goodenough,Esq. F. R. S.
⊙ Henry Goodwyn, Esq.
Lt. Col. Thomas William Gordon.
Standford Graham, Esq.
⊙ Henry Grant, Esq.
⊙ Robert Greenhill, Esq. M. P.
Francis Gregor, Esq.
Joseph Grote, Esq.
⊙ John Guillemard, Esq. F. R. S.
James Fayting Gyles, Esq. A. M.

⊙ Earl of HARDWICKE, K. G. LL. D. F. R. S. and F. A. S.
Earl of HAREWOOD, F. A. S.
Lord HOLLAND, F. R. S.
⊙ Lord HENNIKER, M.P. LL.D. F.R.S. and F. A. S.
Sir James Hall, Bart. F. R. S.
Sir Edmund Craddock Hartopp, Bart.
Sir Robert Bateson Harvey, Bart.
⊙ Lt. Gen. Sir Charles Hastings, Bart.
⊙ Sir J. Cox Hippisley, Bart. M. P. LL.D. F. R. S. and F. A. S.
⊙ Sir Benjamin Hobhouse, Bart. M.P. F. R. S. and F. A. S.
Sir Christopher Hawkins, Bart.
⊙ Sir Everard Home, Bart. F.R.S. and F. A. S.
William Haldimand, Esq.
John Hale, Esq.
⊙ Benjamin Hall, Esq. M. P. F. R. S.
T. ⊙ John Hall, Esq.
William Hamilton, Esq. F. R. S. and F. A. S.
Thomas Harris, Esq.
Benjamin Harrison, F. A. S.
⊙ Thomas Harrison, Esq. A.M. F.R.S. *Commis. Univ. Cantab.*
Francis Hartwell, Esq.
⊙ Thomas Harvey, Esq.
Joseph Haskings, Esq.
⊙ C. Hatchett, Esq. F.R.S. and F.A.S.

Henry Arthur Herbert, Esq.
Henry Hinckley, Esq.
⊙ Charles Hoare, Esq. F. A. S.
⊙ Henry Hoare, Esq, F. A. S.
⊙ Henry Hugh Hoare, Esq. F.R.S. and F. A. S.
⊙ Prince Hoare, Esq.
⊙ Robert Holford, Esq. F. R. S.
⊙ Charles Holford, Esq.
⊙ Henry Holland, Esq. A. M.
⊙ T. Hope, Esq. F. R. S. and F. A. S.
Henry Philip Hope, Esq.
John Hornby, Esq.
Leonard Horner, Esq.
Miss Euphemia Jane Hunter.
Joseph Hume, Esq.
Joseph Hurlock Esq. F. L. S.
Benjamin Hyett, Esq. F.R.S. and F.A.S.

Christopher Idle, Esq.
Elijah Barwell Impey, Esq.
⊙ Daniel Ince, Esq.

John Jacob, Esq.
⊙ Thomas Jeans, Esq.
Robert Jenner, Esq.
Mrs. Elizabeth Jones.
T ⊙ Gibbes W. Jordan, Esq. A.M. F.R.S.

Lord KINNAIRD.
Lord KEITH, G. C. B. F. R. S.
⊙ Robert Keate, Esq.
Samuel Kenyon, Esq.
John Kingston, jun. Esq.
⊙ Hon. Douglas Kinnaird.
Colonel William Kirkpatrick.
Charles Knyvett, jun. Esq.
Major General Kyd.

⊙ Marquis of LANSDOWNE, LL.D. F.R.S.
David Lance, Esq.
Charles Lane, Esq. F. L. S.
James Laird, M. D.
Edward Lee, Esq.
⊙ Thomas Lewis, Esq.
⊙ John Engleberts Liebenrood, Esq.
Emanuel Baruh Lousada, Esq.
Wilson Lowry, Esq. F. R. S.

John William Lubbock, Esq.
William Luxmore, Esq.

⊙ Earl of Morton, K. T. F. R. S. and F. A. S.
Earl of Mansfield, F.R.S. and F.A. S.
Earl of Morley, F. R. S.
Earl of Mountnorris, F.R.S. F.A.S. and F. L. S.
Lord Macdonald.
⊙ Hon. Edward Monckton.
Sir John Macpherson, Bart. F. A. S.
Sir Oswald Mosely, Bart. F. R. S. and F. A. S.
John Mac Arthur, LL. D.
John Macnamara, Esq.
Neill Malcolm, Esq.
⊙ William Manning, Esq.
⊙ Alexander Marcet, M. D. F. R. S.
William Marsden, Esq. LL. D. V.P.R.S. and F. A. S.
John Martineau, Esq.
Christopher G. Marwade, Esq.
Thomas James Mathias, Esq. A. M. F. R. S. and F. A. S.
Samuel Mellish, Esq.
George Meredith, Esq. F. A. S.
⊙ Js. Meyrick, Esq. F.R.S. and F.A.S.
⊙ William Mitford, Esq.
⊙ Daniel Moore, Esq. F. R. S. F. A. S. and F. L. S.
George Moore, Esq.
William Moore, M. D.
William Morgan, Esq. F. R. S.
Charles Morgan Robinson Morgan, Esq. M. P.
Alexander Morison, M. D.
⊙ Scrope Bernard Morland, Esq. M. P. LL. D.
T ⊙ Francis Bernard Morland, Esq.
⊙ William Morley, jun. Esq.
⊙ James Moss, Esq.
⊙ George Moubray, Esq.
William Mount, Esq.
⊙ Thomas Murdoch, Esq. F. R. S and F. A. S.

T ⊙ Rt. Hon. Sir John Nicholl, M. P LL.D. F. R. S. and F. A. S.
⊙ John Nesbitt, Esq.
Charles Dalston Nevinson, M. D.
Thomas Nixon, Esq.
Noel Gerard Noel, Esq.
Peter Nouaille, Esq. F. L. S.
Admiral Charles Edmund Nugent.

⊙ Thomas Oliver, Esq.

Earl of Pomfret.
⊙ Viscount Palmerston, M. P.
Sir Lawrence Palk, Bart. LL. D.
Edward Parry, Esq.
⊙ Major Charles Pasley.
⊙ Archibald Paxton, Esq.
Major Gen. Sir Warren Peacocke.
⊙ Rev. William Pearson.
John Pearson, Esq. F. R. S.
⊙ John Penn, Esq. LL. D.
⊙ William Hasledine Pepys, Esq. F. R. S.
⊙ James Perry, Esq.
John Perry, Esq.
Philip Perry, Esq.
T ⊙ Louis Hayes Petit, Esq. A. M. F. R. S. F. A. S. and F. L. S.
⊙ Rev. William Joseph George Philips, A. M.
⊙ Charles Pieschell, Esq.
⊙ Charles Pilgrim, Esq.
Thomas Pitt, Esq. F. A. S.
William Morton Pitt, Esq. M.P. F.R.S.
Richard Chicheley Plowden, Esq.
John Pond, Esq. Astron. Roy, F. R. S.
Robert Pott, Esq.
George Powney, Esq.
⊙ Samuel Prado, Esq.
⊙ Edward Protheroe, Esq. M. P.
⊙ William Price, Esq.

Sir John Buchanan Riddell, Bart.
⊙ Rev. Thomas Rackett, M.A. F.R.S. F. A. S. and F. L. S.
⊙ George Ranking, Esq.
⊙ Matthew Raper, Esq. F. R. S. and V. P. A. S.
Joshua Reeves, Esq.
John Reeves, Esq. F. R. S. and F.A.S.
John Rennie, Esq. F. R. S. *Lond.* and *Edin.* F. A. S. and F. L. S. M. R. I. A.

John Gibbs Ridout, Esq. F. L. S.
⊙ Rev. John Robinson.
⊙ John Peter Robinson, Esq.
⊙ Peter Mark Roget. M. D. F. R. S.
Thomas Rowcroft, Esq.
T Daniel Henry Rucker, Esq.

⊙ Duke of SOMERSET, F. R. S.
⊙ Marquis of STAFFORD, K. G.
T ⊙ Earl SPENCER, K. G. F. R. S. and F. A. S.
⊙ Earl of SELKIRK, F. R. S.
Right Hon. John Sullivan, M. P.
Hon. John Winfield Stratford.
Sir Mark Masterman Sykes, Bart. M.P. F. A. S.
Sir John Sinclair, Bart. LL.D. F. R. S. and F. A. S.
⊙ Sir John Thomas Stanley, Bart. F. R. S. and F. A. S.
Sir George Thomas Staunton, Bart. F. R. S. and F. L. S.
Sir John Saunders Sebright, Bart. M.P.
Joseph Sabine, Esq. F. R. S. F. A. S. and F. L. S.
⊙ Samuel Sanders, jun. Esq.
⊙ John Sanders, Esq F. A. S.
John Sanderson, Esq.
Alexander Saunderson, Esq.
T William Salmond, Esq.
Peter Schmidtmeyer, Esq.
⊙ Claude Scott, Esq.
David Scott, Esq.
⊙ Samuel Seawell, Esq.
William Simons, Esq.
John Skottowe, Esq.
Rev. W. Boultby Sleath, D. D. F. A. S.
⊙ Samuel Smith, Esq. M. P.
George Smith, Esq. M. P.
Benjamin Smith, Esq.
James Smithson, Esq. F. R. S.
⊙ Thomas Snodgrass, Esq.
⊙ John Soane, Esq. F. A. S.
⊙ Samuel Solly, Esq. F. R. S.
⊙ Samuel Reynolds Solly, Esq. A. M. F. A. S.
⊙ Richard Horsman Solly, Esq. A. M. F. R. S. and F. A. S.
⊙ William Sotheby, Esq. F. R. S. and F. A. S
⊙ James Stodart, Esq.
William Stodart, Esq.
James Strange, Esq
Alexander Stephens, Esq.
⊙ Edward Stracey, Esq. F. A. S.
John Symmons, Esq. F. R. S. F. A. S. and F. L. S.

Lord TEIGNMOUTH.
Robert Taylor, Esq.
⊙ Giles Templeman, Esq.
Garnet Terry, Esq.
William Terry, Esq.
⊙ John Thomson, Esq.
⊙ Richard Thomson, Esq.
Robert Thornton, Esq. M. P. F. A. S.
⊙ Sam. Thornton, Esq. M. P. F. A. S.
⊙ Lieut. Gen. W. Thornton, M. P.
Robert Morgan Tighe, Esq.
Miss W. B. Trail.
John Hinton Tritton, Esq.
James Trotter, Esq.
Samuel Turner, Esq.
John Frewen Turner, Esq.
Charles Hampden Turner, Esq.

Thomas Richard Underwood, Esq.

⊙ Anthony Barto Vallé, Esq.
Joseph Fitzwilliam Vandercom, Esq.
⊙ William Vaughan, Esq.
⊙ Peter Vere, Esq. F. A. S.

⊙ Earl of WINCHILSEA and NOTTINGHAM, K. G. F. R. S. and F. A. S.
⊙ Right Hon. Sir J. Borlase Warren, Bart. G. C. B.
Right Hon. William Wickham.
Hon. James Stuart Wortley.
Sir Mark Wood, Bart, M. P. F. A. S.
Sir Watkins Williams Wynne, Bart. M.P.
⊙ John Walker, Esq. F. R. S. F. A. S. and F. L. S.
Joseph Lyons Walrond, Esq.
⊙ H. Warburton, Esq. A. M. F. R. S.
⊙ Robert Ward, Esq.

⊙ Samuel Ware, Esq.
⊙ Martin Ware, Esq.
⊙ James Warre, Esq.
Thomas Warre, Esq.
⊙ John Warren, Esq.
Pelham Warren, M. D.
George Watlington, Esq.
T ⊙ William Watson, Esq. F. R. S.
⊙ James Watt, Esq.
Frederick Webb, Esq.
⊙ Josiah Wedgwood, Esq.
Walter Weldon, Esq.
Rev. Thomas White.
John Wiggin, Esq.
William Wilberforce, Esq. M. .
Roger Wilbraham, Esq. F. R. S. and F. A. S.
Glocester Wilson, Esq. F. R. S.
⊙ W. Hyde Wollaston, M. D. F. R. S.
⊙ Edward Wood, Esq.
Rev. Basil Woodd.
⊙ Nathaniel Wright, Esq.
Mrs. Elizabeth Wright.
William Wynch, Esq.

Lord YARBOROUGH, F.R.S. and F.A.S.
Sir William Laurence Young, Bart.

The following Persons have paid their Contributions as Members, but have not been presented at a General Monthly Meeting for Admission.

The Lord Bishop of St. DAVID'S.
Lord WEBB SEYMOUR, F. R. S. *Lond.* and *Edin.* F. L. S.
Rear Admiral Sir Edward Codrington, K. C. B.
Hon. J. W. Ward.
⊙ James Alexander, Esq.
James Broadwood, Esq.
William Rickson Beecher, Esq.
Richard Hart Davis, Esq. M. P. F.R.S.
Andrew Gregory Johnstone, Esq.
Joseph Smith, Esq.
William Walcot, Esq.
George Wilbraham, Esq.
Thomas Brandam, Esq.
John George Seppings, Esq.
Thomas Hoblyn, Esq.
Frederick Hodgson, Esq.
Anthony Bertolacci, Esq.
Samuel Parkes, Esq.
Capt. W. C. Holloway.
Samuel P. Wright, Esq.

A List of Books presented to the Library of the Royal Institution, in the year 1816.

1816.		Donors.
Jan. 14.	A Treatise on the Valuation of Annuities and Assurances on Lives and Survivorships, 2 vol. 8vo.	Joshua Milne, Esq.
	The Barrington School, 3d edition, 8vo.	Sir T. Bernard, Bart. M. R. I.
22.	A Statement of the early Symptoms which lead to Water on the Brain, 8vo.	Dr. Yeats.
	On the Fire Damp of Coal Mines, 8vo.	Sir H. Davy, F. R. S. V. P. R. S. &c.
Feb. 13.	A Treatise on the Mineral Waters of Gilsland,	W. R. Clanny, M. D. M. R. I. A.
	Letters on Public House licensing.	Barber Beaumont, Esq.
26.	Catalogue of British Specimens in the Geological Collection of the Royal Institution, 8vo.	W. T. Brande, Esq. Prof. of Chem. R. I. and Sec. R. S.
	Catalogue des Livres de M. Le Comte de Mac Carthy, 2 vol. 8vo.	Earl Spencer, President of the R. I.
	Trial between Moore and Adam for an Assault at Alicant in Spain, 8vo.	Thomas Moore, Esq.

1816.		
Mar. 18.	Further Proceedings of the Honourable House of Assembly of Jamaica relative to the Bill for preventing the unlawful Importation of Slaves in the British Colonies,	George Hibbert, Esq.
	Copies of a Letter containing Queries respecting the State of the Silver and Copper Coins in the Island of Barbadoes, 8vo.	G.W.Jordan, Esq.F.R.S. and M. R. I.
April 8.	Catalogue of the Books and Manuscripts in the Library of the Society of Antiquaries, 4to.	The Society of Antiquaries.
	Remarks on the Pharmacopœia Londinensis,	Mr. Richard Phillips.
	A Chinese Poem, with a Translation and Notes,	The Rev. Steph. Weston, F. R. S.
	Epitome of a Scheme of Finance,	Patrick Colquhoun, Esq.
24.	Vol. XXXIII. of the Transactions of the Society of Arts, Manufactures, and Commerce, 8vo.	The Society of Arts, &c.
	An Enquiry into the Literary and Political Character of King James I. 8vo.	J. D'Israeli, Esq.
	An Introduction to Geology, by Robert Bakewell, 2d edition, 8vo.	Mr. J. Harding.
	Three Familiar Lectures on Craniological Phisiognomy, 8vo.	The Author.
May 13.	The Principles of Population and Production, as they are affected by the Progress of Society; with a View to moral and political Consequences, 8vo.	John Weyland, jun. Esq. F. R. S.
20.	Remedies proposed for the Relief of our present Embarrassments,	John Symmons, Esq. F. R. S. and M. R. I.
	Bertram; a Poetical Tale in Four Cantos, 12mo.	Sir Eger. Brydges, Bart.
June 10.	Edda Rhythmica seu antiquior, vulgo Sæmundina dicta, 4to.	Sam. Solly, Esq. F. R. S. and M. R. I.
July 1.	Mr. Basil Montagu's Selection of Opinions upon the Punishment of Death, 3 vol. 8vo.	Society for the Diffusion of Knowledge respecting the Punishment of Death.
8.	Martini Lutheri Opera omnia, 7 vol. folio. Philippi Melancthonis Opera omnia, 4 vol. folio. Joannis Hus, et Hieronymi Pragensis Historia et Monumenta, 2 vol. folio,	Earl Spencer, President of the Royal Inst.
	Theophrasti Eresii Historia Plantarum, Gr. 2 vol. 8vo.	John Stackhouse, Esq. F. L. S.
	Spurinna; or the Comforts of Old Age, 8vo.	Sir Thos. Bernard, Bart. M. R. I.
	An Essay on the Construction of a Turnpike Gate,	Thomas N. Parker, Esq.
Sept. 8.	Conversations on Political Economy, in which the Elements of that Science are familiarly explained.	The Author.
	An Analysis of the Mineral Water of Tunbridge Wells,	Dr. Charles Scudamore.
Oct. 10.	An Address delivered to the Inhabitants of New Lanark on January 1, 1816. A New View of Society; or, Essays on the Formation of the Human Character, 8vo.	Mr. Robert Owen, of Lanark.
	The Colonial Journal, No. II.	The Publishers.
Dec. 2.	A Grammar of the German Language, 8vo.	George Henry Noehden, LL. D.
	Transactions of the Geological Society, Vol. II. and III.	The Geological Society.
	Augusteum; Dresdens antike Denkmäler enthaltend; Herausgegeben von W. G. Becker, folio,	Samuel Solly, Esq.
Dec. 12.	An Account of the Visit of His Royal Highness the Prince Regent, with their Imperial and Royal Majesties the Emperor of all the Russias and the King of Prussia, to the Corporation of London, in June 1814; and also the Entertainment to his Grace the Duke of Wellington, 9th July 1814, folio,	The Corporation of London.
	Philosophical Transactions for 1816, 2 parts,	The Royal Society.
	On the Lines that divide each semidiurnal Arc into Six equal Parts, 4to.	W. A. Cadell, Esq. F. R. S. Lond. and Edin.
	The Repository of the Arts, for 1816,	Mr. Akermann, the Publisher.
	European Magazine, for 1816,	Mr. Asperne, the Pub-

List of Donations to the Mineralogical and Geological Collection, in 1816.

PRESENTS.	Donors.
Specimens of volcanic minerals from Vesuvius,	Sir H. Davy.
A series of specimens from the Isle of Arran, &c.	H.M.Da Costa, Esq.
A series of specimens illustrating the geology of Cornwall, Devonshire, and the Western Counties in general,	J. F. Daniell, Esq. and W. T. Brande, Esq.
Ditto from North and South Wales,	Ditto, Ditto.
Ditto from several parts of Scotland,	Ditto, Ditto.
Ditto north of Ireland,	Ditto, Ditto.
Geological specimens from Cumberland and Westmoreland,	T. Allan, Esq.
Green oxide of uranium from Cornwall,	Mr. Mawe.
A series of Derbyshire toadstones,	Ditto.
Wavellite from Barnstaple,	Ditto.
Specimens of black sulphuret of copper, of carbonate of lead, and of oxide of tin from Cornwall,	W. T. Brande, Esq.
Various specimens of polished marble from Shropshire,	W. Porden, Esq.
Materials used in the manufacture of pottery,	J. Wedgwood, Esq.
Specimens of the coal strata of Northumberland,	H. G. Horn, Esq.
Specimens of chromate of iron from Norway,	Dr. Esmark.

The following Donations have also been received for the purchase of Minerals;

Daniel Moore, Esq. 21 *l.*
J. Frederic Daniell, Esq. 21*l.*
W. T. Brande, Esq. 21*l.*
J. Sanders, Esq. 10*l.* 10*s.*
A. Copland, Esq. 21*l.*

The Descriptive Catalogue of the Geological Collection may be had at the Institution, and at Messrs. Longmans, Paternoster-row.

Select List of New Publications, from July, 1816, to the 20th of March, 1817.

Natural History.

General Zoology; or Systematic Natural History, commenced by the late George Shaw, M. D. Vol. IX. in two parts. By James Francis Stephens, F. L. S. 8vo. 2l. 12s. 6d. royal paper, 3l. 16s.

A Treatise on Greyhounds, with Observations on their Treatment and Disorders. 8vo. 5s.

A History of the Earth and Animated Nature. By Oliver Goldsmith; illustrated with copper plates. With Corrections and Additions, by W. Turton, M. D. F. L. S. 6 vols. 8vo. 3l.

An Essay on Human Hair. By Alexander Rowlandson, 8vo. 5s.

Appendix to the first edition of Kirby and Spence's Insects; comprising the additional matter inserted in the second edition, 8vo. 1s. 6d.

The Elements of Conchology, according to the Linnæan System: illustrated by 28 plates, drawn from nature. By the Rev. E. J. Burrows, A. M. F. L. S. 8vo. 16s.

The Elements of Conchology; or Natural History of Shells, according to the Linnæan System. With Observations on Modern Arrangements. By Thomas Brown, Esq. 8vo. 8s. plain, 12s. coloured.

Botany.

A System of Physiological Botany. By the Rev. P. Keith, F. L. S. 2 vols. 8vo. 1l. 6s.

Compendium Floræ Britannicæ. Second edition, corrected, and continued to the end of the third volume of the Flora Britannica. With all the newly discovered Plants from the English Botany, and references to that work throughout. Auctore Jacobò Eduardo Smith, Esq. Aur. M.D. Societatis Linnæanæ Præside, &c. 12mo. 7s. 6d.

The Florist's Manual; or Hints for the Construction of a gay Flower Garden, &c. By the Authoress of Botanical Dialogues, 12mo. 4s. 6d.

The Botanist's Companion; or an Introduction to the Knowledge of Practical Botany, and the Uses of Plants, either growing wild in Great-Britain, or cultivated for the purposes of Agriculture, Medicine, Rural Economy, or the Arts, on a new Plan. By William Salisbury, 2 vols. 12mo.

Flora Tunbrigensis; or a Catalogue of Plants growing wild in the neighbourhood of Tunbridge Wells; arranged according to

the Linnæan System, from Sir J. E. Smith's Flora Britannica. By T. F. Forster, F. L. S. 8vo. 9s.

CHEMISTRY.

A Practical Treatise on Chemical Re-agents or Tests; illustrated by a series of experiments, calculated to shew the general nature of chemical re-agents; the effects which are produced by the action of those bodies; the particular uses to which they may be applied in the various pursuits of chemical science, and the art of applying them successfully. By Frederick Accum, Operative Chemist, 12mo. 5s.

GEOLOGY.

Transactions of the Geological Society, established Nov. 13, 1807. Vol. III. with plates, &c. 4to. 3l. 13s. 6d.

Transactions of the Geological Society. Vol. IV. Part I. 18s.

Outlines of Geology, by W. T. Brande, Sec. R. S. &c

AGRICULTURE AND RURAL ECONOMY.

The Agricultural State of the Kingdom in February, March, and April, 1816; being the volume printed by the Board of Agriculture, and subsequently suppressed, 8vo. 15s.

The System of Farming practised at Teston, in Kent, 8vo. 1s.

Observations on a new mode of Stacking Corn, peculiarly adapted to wet seasons, recommending a plan successfully practised, by which corn may be stacked with advantage, soon after being cut down. By William Anderson, farmer, Angusshire, 8vo. 1s. 6d.

A Treatise on the Physiology and Pathology of Trees; with Observations on the Barrenness and Canker of Fruit Trees, the means of Prevention and Cure. By P. Lyon, 8vo. 10s. 6d.

Fragments on the Theory and Practice of Landscape Gardening, containing some remarks on Grecian and Gothic Architecture, &c. &c. By H. Repton, Esq. assisted by his son, John Adey Repton, F. S. A. imperial 4to. 6l. 6s.

GEOGRAPHY.

A View of the Present Condition of the States of Barbary: or an Account of the Climate, Soil, Produce, Population, Manufactures, and Naval and Military Strength of Morocco, Fez, Algiers, Tripoli, and Tunis. By W. Janson, 12mo. 5s.

An Account of Tunis, its Government, Manners, Customs, and Antiquities; especially of its Productions, Manufactures, and Commerce. By Thomas Macgill, 8vo. 7s.

Historical Memoirs of Barbary, and its Maritime Power, as connected with the plunder of the seas; including a Sketch of Algiers, Tripoli, and Tunis, 18mo. 2s. 6d.

Documents relative to the Kingdom of Hayti. By P. Sanders, Esq. Agent to the King of Hayti, 8vo. 10s. 6d.

A new and correct Map of the United States of America, on Six Sheets; carefully compiled from Surveys and the most authentic Documents. By Samuel Lewis, 1l. 6s. mounted.

MEDICINE, SURGERY, ANATOMY, AND PHYSIOLOGY.

Practical Illustrations of Typhus Fever, Dysentery, Erysipelas, Visceral Inflammations, Acute Rheumatism, Ophthalmia, Apoplexy, Madness and other Diseases. By John Armstrong, M. D. 8vo. 10s. 6d.

Observations on the Harveian Doctrine of the Circulation of the Blood. By George Kerr, 12mo. 4s.

A Treatise on Diseased Spine, and on Distorted Spine, with cases to illustrate the success of a new method of cure. By T. Sheldrake, 8vo.

Practical Observations on the Diseases of the Urinary Organs, particularly those of the Bladder, Prostate Glands, and Urethra. Illustrated by Cases and Engravings. By John Houship, with four plates, 8vo. 15s.

An Answer to Dr. Kinglake, shewing the danger of his cooling treatment of the Gout. By John King, 8vo. 5s. 6d.

Medico-Chirurgical Transactions, published by the Medical and Chirurgical Society of London. With four plates, Vol. VII. Part I. 8vo. 10s. 6d.

The same, Vol. VII. Part II. 8vo. 12s.

An Introduction to Comparative Anatomy and Physiology: being the two Introductory Lectures, delivered at the Royal College of Surgeons, by William Lawrence, F. R. S. 8vo. 6s.

A Treatise on the Nature and Cure of Gout; comprehending a General View of a morbid State of the Digestive Organs, and of Regimen, with some Observations on Rheumatism. By Charles Scudamore, M. D. 8vo. 12s.

The Principles of Surgery, as they relate to Surgical Diseases and Operations. By John Bell, Surgeon, Parts I. to XII. 4to. 12s. each.

Surgical Observations: being a Quarterly Report of Cases in Surgery. By Charles Bell, Part I. 8vo. 6s.

Delineations of the Cutaneous Diseases comprised in the Classification of the late Dr. Willan; being a Republication of the greater part of the Engravings of that author in an improved state. Together with a new Series, which will comprehend the remainder of the System, as completed in the "Practical Synopsis of Cutaneous Diseases." By Thomas Bateman, M. D. Fasciculus VII. with six coloured Plates, 4to. 1l. 1s.

A Memoir on the cutting Gorget of Hawkins, by Antonio Scarpa, with an Engraving. To which is added a Biographical

Account of J. B. Carcano Leone. Translated from the Italian, by J. H. Wishart, 8vo. 5s.

An Epitome of Juridical and Forensic Medicine; with Observations on Hanging, Drowning, Lunacy, Child-Murder, Abortion, &c. for the Use of Coroners, Medical Men, and Barristers. By George Edward, Male, M. D. 8vo. 7s.

A Treatise on the Diseases of the Arteries and Veins; containing the Pathology and Treatment of Aneurisms and Wounded Arteries. By John Hodgson, Member the of Royal College of Surgeons in London, 8vo. 15s.

Report of Observations made in the British Military Hospitals in Belgium, after the Battle of Waterloo. With some Remarks on Amputation. By John Thomson, M. D. F. R. S. E. Professor of Military Surgery to the University of Edinburgh, &c. 8vo. 8s.

Some Practical Observations in Surgery, illustrated by Cases embracing the subjects of Amputation, Erysypelas, Necrosis, Internal Abscess, &c. By A. C. Hutchinson, 8vo. 7s.

An Essay on the common Cause and Prevention of Hepatites, or Bilious Complaints in general, as well in India as in Europe. With an Appendix, recommending the old Sub-muriates of Mercury, in preference to those now in use. By Charles Griffith, M. D. 8vo. 7s.

Observations on the projected Bill for restricting the Practice of Surgery and Midwifery to Members of the Royal Colleges of London, Edinburgh, and Dublin, and to Army and Navy Surgeons. With some modifications proposed, by which the measure will be more compatible with the true interests of the public, and not oppressive to the present race of pupils, 8vo. 3s. 6d.

A Vindication of the University of Edinburgh, as a School of Medicine, from the Aspersion of a Member of the University of Oxford. By Lawson Whalley, M. D. 8vo. 2s.

A Treatise on Uterine Hæmorrhage, by Duncan Stewart, M. D. 8vo. 6s.

Elements of Physiology, by A. Richerand, Professor of the Faculty of Medicine of Paris, &c. Translated from the French, by J. G. M. De Lys, 8vo. 12s.

Synopsis Nosologiæ, or Outlines of a New System of Nosology. By T. Parkinson, M. D. 8vo. 9s.

Medical, Geographical, and Agricultural Report of a Committee appointed by the Madras Government to inquire into the Causes of the Epidemic Fever, during the years 1809, 1810, and 1811. 8vo. 6s. 6d.

An experimental Enquiry into the Effects of Tonics and other Medicinal Substances on the cohesion of the animal Fibre. By the late Adair Crawford, M. D. F. R. S. Edited by Alexander Crawford, M. D. 8vo. 6s.

Observations on the Structure of the Brain; comprising an Estimate of the Claims of Drs. Gall and Spurzheim to discovery in the Anatomy of that Organ. By John Gordon, M. D. F. R. S. E. With Plates, 8vo. 7s. 6d.

The Institutions of Physiology by Professor Blumenbach; translated from the Latin, and supplied with numerous and extensive Notes, by John Elliston, M. D. 8vo. 10s. 6d.

Engravings intended to illustrate some of the Diseases of Arteries. With Explanations, by Joseph Hodgson, 4to. 1l. 16s.

A Practical Explanation of Cancer in the Female Breast: with the Method of Cure, and Cases of Illustration. By John Redman, M. D. 8vo. 8s.

Anecdotes, Medical, Chemical, and Chirurgical. Collected, arranged, and translated by an Adept. 2 vol. 12mo. 10s. 6d.

A Caution to Vaccine Swindlers and Impostors. By John King, 8vo. 5s.

Medical Suggestions for the treatment of Dysentery, of Intermittent and Remittent Fevers, as generally prevalent at certain seasons among troops in the field. By E. S. Somers, M. D. 8vo. 6s.

Mechanical Philosophy and Mathematics.

Elements of Mechanical and Chemical Philosophy. By John Webster. Illustrated by numerous Wood-cuts, 8vo. 10s.

An Elementary Treatise in the Differential and Integral calculates. By S. F. La Croix, translated from the French, 8vo. 18s.

Elements of Plane and Spherical Trigonometry; with their applications to heights and distances, projections of the Sphere, Dialling, Astronomy, the Solution of Equations, and Geodesic Operations. By Olinthus Gregory, LL.D. 12mo. 5s.

An Elementary Treatise on Astronomy, or an easy Introduction to the knowledge of the Heavens. By the Rev. A. Mylne, 8vo. 9s.

A Treatise on Spherics; comprising the Elements of Plane and Spherical Geometry, and of Plane and Spherical Trigonometry; together with a series of Trigonometrical Tables. By D. Cresswell, Fellow of Trinity College, Cambridge, 8vo. 7s.

An Essay on the Origin and present state of Galvanism; containing Investigations of the Principal Doctrines offered for the Explanation of its phenomena. By M. Donovan, 8vo. 12s. 6d.

Time's Telescope for 1817; or, a Complete Guide to the Almanack: containing an Explanation of Saint's Days and Holydays; with Illustrations of British History and Antiquities, Notices of obsolete Rites and Customs, and Sketches of Comparative Chronology, Astronomical Occurrences in every month; comprising Remarks on the Phenomena of the Celestial bodies: and the Naturalist's Diary; explaining the various appearances

in the Animal and Vegetable Kingdoms. To which is prefixed an Introduction, containing the Principles of Zoology. Published Annually, 12mo. 9s.

An Introduction to the Method of Increments, expressed by a new form of Notation; shewing more intimately its relation to the Fluctional Analysis. By Peter Nicholson, 8vo. 8s.

A Course of Military Instruction; comprising Practical Geometry, the Principles of Plan-drawing, and Elementary Fortification. By Lieut. Col, Pasley, 8vo. 3 vol. with 1100 Engravings. 3l.

GENERAL SCIENCE.

The Supplement to the Encyclopedia Britannica. Edited by Macvey Napier, Esq. F. R. S. E. 4to. Vol. II. Part I. 1l. 5s.

VOYAGES AND TRAVELS.

Observations on England, its Laws, Manufactures, Commercial and Civil Polity ,Manners, Customs, and Vices. Translated from the Original Manuscript Letters of Oloff Napea, formerly an Officer of Cavalry in the Russian Service, 8vo. 8s.

Voyages and Travels in the South Sea. By W. Burney, vol. iv. royal 4to. 2l. 10s.

Travels in Upper Italy, Tuscany, and the Ecclesiastical State, in a Series of Letters written to a friend in the years 1807 and 1808. By Baron d'Uklanski, 12mo. 2 vols. 1l. 1s.

A Diary of a Journey into North Wales. By the late Samuel Johnson, LL.D. Printed from the original MS. in his own handwriting; together with a fac.

Journal of Travels in Sweden, Russia, Poland, &c. during the years 1813 and 1814. By the Rev. T. James, of Christ Church, Oxford, 4to. 3l. 3s.

Sketches of India: or Observations descriptive of the Scenery, &c. in Bengal. Written in India in the years 1811, 1812, 1813, and 1814. Together with notes on the Cape of Good Hope, and St. Helena, written in those places in February, March, and April. 1816. 8vo. 7s.

The Traveller's Guide in Switzerland, describing every object of curiosity, &c. &c. By Henry Coxe, Esq. 12mo. 5s.

A Tour through some parts of Istria, Carniola, Styria, Austria, the Tyrol, Italy, and Sicily, in the spring of 1811. By a young English merchant.

Travels in Brazil, from Pernambuco to a Seara, besides occasional Excursions. By Henry Koster. Illustrated by Plates of Costumes, 4to. 2l. 10s.

Itinerary of the Morea; being a description of the Routes of that Peninsula. By Sir William Gell, Bart. with a map, 8vo. 10s. 6d.

Mungo Park's First Expedition to Africa, 4to. a New Edition, with maps, &c. 2l. 2s.

The History of Ceylon, from the earliest period to the year 1815; with characteristic details of the Religion, Laws, and Manners of the people, and a collection of their moral maxims and ancient proverbs. By Philalethes, A. M. Oxon. (i. e. Rev. Robert Fellowes.) To which is subjoined Robert Knox's Historical Relation of the Island, with an Account of his Captivity during a period of nearly 20 years, 4to. 2l. 12s. 6d.

A View of the Agricultural, Commercial, and Financial Interests of Ceylon; illustrated by Official Documents. By Anthony Bertolacci, Esq. &c. &c. and a map compiled at Columbo from the latest Surveys in the year 1813, by Captain Senneider, Ceylon Engineer, 8vo.

Narrative of a Residence in Belgium during the Campaign of 1815, and of a visit to the Field of Waterloo. By an English Woman, 8vo. 12s.

An Account of the singular Habits and Circumstances of the People of the Tonga Islands, in the South Pacific Ocean. By William Mariner, of the Port au Prince, private ship of war, the greater part of whose crew was massacred by the natives of Lefooga, 8vo. 2 vol. 1l. 4s.

Memorandums of a Residence in France, in the winter of 1815-16; including Remarks on French manners and Society; with a Description of the Catacombs, and notices of some other objects of curiosity, and works of Art, not hitherto described. 8vo. 12s.

Travels in Upper Italy, Tuscany, and the Papal Ecclesiastical State, in 1807 and 1808. By Baron d'Uklanski, 12mo. 2 vol. 1l. 1s.

Peninsular Sketches during a recent Tour, by John Mitford, Jun. 8vo. 8s.

A Tour through Belgium, Holland, and along the Rhine, and through the North of France in 1816. By James Mitchell, M. A. 8vo. 12s.

Narrative of a Journey in Egypt and the Country beyond the Cataracts. By Thomas Legh, Esq. M. P. 4to. 1l. 1s.

Narrative of a Residence in Ireland in 1814 and 1815. By Anne Plumptree, 4to. 2l. 10s.

The Unedited Antiquities of Attica, comprising the Architectural Remains of Eleusis, Rhamnus, Sunuim, and Thoricus. Published by the Dilettanti Society. Imperial folio, 10l. 10s.

A Quarterly List of Foreign Scientific Publications.

Natural History.

1. Histoire de polypiers corralig ènes flexibles, vulgairement nommés Zoophites, 1 vol. 8vo. Par M. Lamoroux.
2. Monographie du Trigonocephale. Par M. de Jonnès. Paris.
3. Mémoires pour servir à l'histoire des Mollusques. Par M. Cuvier, 1 vol. 4to. Paris.
4. Systéme du Regne Animal. Par MM. Cuvier et Latreille, 4 vol. 8vo. plates. Paris.
5. Dictionnaire d'Histoire Naturelle. Nouvelle Edition, plates. 2d. Livraison of 4th, 5th, 6th vol. Daterville.
6. Dictionnaire d'Histoire Naturelle. Nouvelle Edition. Levrault, 1st. and 2d. vol. Supplement and plates
7. Die Voegel der Schweitz, &c. or Systematic Description of the Birds of Switzerland, 1 vol. Zurich.
8. Natur Koerper, &c. or the Anorganic bodies of Nature considered with respect to their affinities, &c. By M. Gravenhorst. Breslau. Vol. gr. in 8vo.
9. *Beitraege*, &c. or Memoir on the Anatomy and Physiology of the Medusæ, 1 vol. By *Gaede*. Berlin.
10. *Elementarbuch*, or Elementary treatise on Entomology, and particularly of the *Scarabées*. By Capt. Malinowsky, 1 vol. Quedlinbourgh.

Botany.

1. Des Plantes rares cultivées à la Malmaison, 8me. cahier. Par Bonpland.
2. Examen d'un ouvrage pui a pour titre "*Illustrationes Theophrasti*," &c. Auctore. I. Stackhouse. Paris.
3. Flore des Environs de Rouen. Par M. Longchamp. Rouen. 2 parts, French and Latin.
4. Flore du Dictionnaire des Sciences Medicales, 26, 27, 28, livraisons, 8vo. plates. Paris.
5. Les Liliacées par Redouté, 80th and last livraison.
6. Algæ aquaticæ quas et in littora maris dynastiam Severanam et Frinam orientalem, &c. collegit et exsiccavit. H. B. Jungers. I. and II. Decad. Hanover.
7. Flora Monacensis quas in lapide pinxit Mayrhoffer. Munich. in fo.
8. Flora Ticinensis, auctoribus Rocca et Balbis. Ticini.

Chemisty, and General Sciences.

1. Mémoires de l'Academie des Sciences de Marseilles.
2. Journal de Pharmacie et des Sciences accessoires. Paris. September, October, November.

3. Memorie della Società Italiana. Parte Fisica. Tomo XVII.
4. Bibliothèque Universelle des Sciences et des Arts. Geneva, July, August, September.
5. Nouvelle Nomencloture Chymique d'après Thenard. Par M. Caventon, 1 vol. 8vo. Paris.
6. Tableaux chimiques du Règne Animal, from the German. By Robinet, 1 vol. 4to.
7. Notice historique sur l'utilisation du Gas Hydrogène. Par Mons. Windsor. Paris.
8. Journal des Sçavans. October. Paris. 4to.

Mineralogy and Geology.

1. Leçons de Géologie données au College de France. Par Delametherie, 3 vol. Paris.
2. La Creation du Monde ou Systeme d'organisation primitive Par un Austratien, 2 Ed. 2 vol. Paris.
3. Observations de Pyrite gilvo. hepatico, et radiato auctorum. By Hausmann, vol. gr. in 8vo. Goettingen.
4. *Bemerkungen*, &c. or Mineralogical observations made on the Carpathian mountains, 2d. Edition.
5. *Handbuch der Oryctognosie*, or Manual of Oryctognosy. By H. Steffens, 2 vol. Halle.
6. *Ueberblik*, &c. or Systematic view of a classification of simple fossiles by Pohl, in 4to. Prague.

Agriculture and Rural Economy.

1. Sur le Systeme des Agriculteurs à l'egard des Abeilles. Par M. Chambon. Paris.
2. Proceedings of the Board of Agriculture at Chalons. Chalons.
3. Notice sur l'Epizootie du gros betail à Alfort. Paris.
4. Mémoir sur l'inoculation du Claveau. Paris.
5. Sur le fabrication des Vins. Par M. Julien. Paris.
6. Notice Topographique de tous les vignobles connus. Par A. Jullien. Paris.
7. Il buon Governo dei bachi da Seta. Del Conte Dandolo. Milan.
8. Notice sur les mots Hippiatre, Vétérinaire, et Marechal. Par M. Huzard. Courcier, 3d. Edition.
9. Manuel du Vigneron du departement de la Moselle. Par M. Jaunez.

Geography.

1. Confutation de quelques erreurs de Strabon. Paris.
2. Trattato Elementaire de Geografia. Del Sig. Flauti. Naples.
3. Carte des côtes de la Barbarie. Par Collin. Paris.
4. Mineraire du Royaume de France, &c. Par Langlois.
5. Carte detaillés des environs de Paris. Par Gotthold.

6. Dictionnaire historique, topographique, &c. des environs de Paris.
7. Briefe, &c. or Letters on the Caucasus, and Persia. By Freygang, 1 vol. gr. in 8vo. Hambourgh.
8. Carta del Novo Regno Lombardo Veneto, 4 sheets. Milan.

MEDECINE, SURGERY, ANATOMY AND PHYSIOLOGY.

1. Traité des Maladies nerveusse, 2 vol. Par M. Villermay.
2. Mémoire sur l'introduction de la fievre jaune dans les Antilles. Par M. de Jonnés. Paris.
3. Mémoire sur les Géophages des Autilles. Idem.
4. Note sur le Magnetisme Animal. Par Montegie. Ed.
5. Dictionnaire des Sciences Medicales. Tom. XVIII. Paris.
6. Essai sur la nature et le caracter des Maladies en général, et sur le mode d'action des medicamens. Par M. de Thoissey. Paris.
7. Difseriation sur les dissenteries. Broch. in 4to. Par M. Bétis, D. M. Paris.
8. Journal universel des Sciences Medicales July.
9. Annales Chimiques de Montpellier. July and August.
10. Journal de Medecine de Leroux. September. October.
11. Bibliotheque Medicale. November.
12. L'Art d'appiiquer le pâte arsenicale. Par le Doct. Patris. Paris.
13. Opuscules d'anatomie et d'Histoire Naturelle. Par G. Roubieu. Montpellier.
14. Ephemerides des Sciences naturelles. Paris. No. II.
15. Nouveaux Aperçus sur les causes et les effets des glaires. Par Dubreuil. Broch. Paris. 8vo.
16. Exposé des bains de vapeur. Par Gerard.
17. Topegraphie physique et medicale des environs de Strasbourgh. Par M. Gnaffenauer, 1 vol. 8vo.
18. *Journal der praktischen Heilkunde*, &c. or Hufeland Journal of practical medicine. April, May, June, 1816. Berlin.
19. *Medizinische Annalen*, or Annals of Medecines, &c. Altenbourgh.
20. *Istoria d'una frattura*, or History of a fracture of the neck of the former mistaken for a dislocation of that bone. By Dr. Benigria. Brescia.
21. *Entwurf eines Systems*, or a System of medical Antropology, &c. By D. Lucoe, 1 vol. Francfort.
22. *Beobachtunger*, &c. Observations sur les concrétions mobiles dans les articulations, &c. By Schreger. Erlang.

MECHANIC PHILOSOPHY, MATHEMATICS, AND ASTRONOMY.

1. Traduction complête de l'Almageste de Ptolomée. Par M. Halma, 2 vols. Paris.

2. Traité Elémentaire du Calcul des Probabilités. Par M. Lacroix, 1 vol. 8vo. Paris.

3. Mémoire sur la Capillarité. Par M. Sarthon.

4. Première et Deuxième Leçons experimentale d'Optique. Par M. Bourgeois. Paris.

5. Annales de Mathématiques pures. Tom. VI. 4to. Nismes.

6. Exercice du Calcul Integral. Par Legendre, 4to.

7. Exposé Sommaire du Système du Monde. Par Jambon, 2d edit.

8. *De Hauptlehren*, &c.; or, Fundamental Principles of Geometry and Trigonometry. By Brandes, 1 vol. 8vo. Oldenburgh.

Voyages and Travels, and Navigation.

1. Voyages de Découvertes aux Terres Australes. Historique. Par Freycinet, 1 vol. 4to. Atlas.

2. Oeuvres de Gauthey, 3d vol. contenant les Mémoires sur les Canaux de Navigation.

3. Manuel du Voyageur en Suisse. Par M. Ebel.

4. Voyage en Savoie, en Piemont, à Nice, et Genes. Par M. Millin, 2 vol. 8vo.

5. Voyages d'un François fugitif dans les années 1791, &c. Paris, 1 vol. 8vo.

List of Foreign Publications since our last.

Natural History.

Vermischte Schriften; or, Essays on various subjects of Natural History, Physiology, Anatomy, &c. By MM. Treviranus, 1st vol. Gottingen, 1816.

Magasin de Physique et d'Histoire Naturelle. Par la Société des Naturalistes de Berlin. VIIIth year, 2d quarter. 1816. Berlin.

Le Règne Animal distribué d'après son Organisation pour servir de Base à l'Histoire Naturelle des Animaux, &c. Par M. Cuvier, 4 vols. 8vo. 25 plates. Paris, 1816.

Mémoires pour servir à l'Histoire et à l'Anatomie des Mollusques. By the Same, 1 vol. 4to.

Les Papillons. Par Ch. Malo, 1 thick vol. 18mo. 12 plates. Paris.

Botany.

Herbier Générale de l'Amateur, &c. XIIth part, being the last of vol. 1st, 8vo. Paris.

Plantes Rares de Malmaison. By Bonpland, Xth part.

Floræ Italicæ Fragmenta, seu Plantæ rariores, in variis Italiæ regionibus, &c. a D. Viviani, fos. 1, gr. in 4to. plates. Genoa.

Darstellung und Beschreibung, &c.; or a Description of the Plants used in Pharmacy. By F. G. Hayne, tome IV. 4to Berlin.

De Distributione Geographica Plantarum Prolegomena. By Humboldt, 1 vol. 8vo. Paris, plate.

Physical Sciences and Chemistry.

Annalen der Physik. Gilberts. August, Sept. Octob. Leipsic.

Darstellung, &c.; or Exposition of the Numeric Differences the Chemical Elements. By Doebereirer, gr. in fol. Jena, 1816.

Versuche, &c.; or, Experiments tending to rectify and promote the progress of Chemistry. By Fricker, 1 vol. gr. in 8vo. Breslau.

Neues Journal der Chimie, &c. Schweiger. Last quarter 1816. Nuremberg.

Annales de Physique et de Chimie. Octob. Nov. December. Paris, 8vo.

Journal de Physique. Nov. Decemb. 1816. Paris, 4to.

Journal de Pharmacie et Scienees Accessoires. Octob. Nov. December, and Jany. 1817.

Mémoires de Statique Chimique; ou Commentaires des Theories Chimiques de Berthollet. Par M. Otto, 1st vol. theoretical part, grande in 8vo. Wisbaden, 1816.

Les Corps Anorganiques de la Nature, considérés et classés d'après leur *affinitiés* et leur transitions. By Gravenhorst, vol. gr. in 8vo. 7 plates. Bratan.

Mathematics, Astronomy.

Metrologie Universelle, ancienne et moderne. By Malaiseau, 1 vol. 4to. Bourdeaux.

Tables de Logarithmes pour les Nombres et les Sinus; from 1 to 20,000 with the Sinus of Tangents, &c. 1 vol. 16mo. Saint Malo.

Zeitschrift für Astronomie; or, Journal of Astronomy and the Analogous Sciences. By Lindenau and Bohnenberger. Numb. for August and Sept. 1816.

Problemes géometriques avec leur Solutions. By Schaeffer, 1 gr. in 8vo. 4 plates. Oldenburgh.

Erweiterungen, &c. Nouveaux Eclaircissemers de Sciences Mecaniques, &c. By Langsdorf, 1 vol. gr. in 8vo. plates. Manheim.

Dyadique; or, Exposition of a System of Numeration, in which every thing is expressed by two signs only. Par *Drais* 2d edit. 1816.

MEDICINE, SURGERY, ANATOMY.

Archiv der Medicin; or Journal of Medicine, Surgery, and Pharmacy. 1st year 1816, 1 vol. 8vo. Arau.

Archives de Physiologie Publics. Par Meckel, 1st vol. 661 pag. plates. Halle, 1816.

Ueber den Zustand, &c.; or, Memoir on the actual State of Ophtalmology in France and Germany. By Wenzel, 8vo. Nuremberg, 1816.

Journal der Praktischen Heilkund, &c.; or, Journal of Medicine. By Hufeland. Last quarter 1816. Berlin.

Bibliothek der Heilkunde, &c.; or, Medical Library of Practical Medicine. By same Author. July, 1816.

Repository of Medical Experiments, published by Dr. Horn. Berlin, 1816.

Ueber die Wirkungen; or, Treatise on the Efficacy of the Sulphuret of Potash in Croup and other Diseases. 1 vol. 8vo. 1816. Halle.

Handbuch der Pathologie; or a Manuel of Pathology and Therapeutics. By Raiman, 1st vol. 8vo. Vienna, 1816.

Medizinische Annalen. May 1816. Altenbourg.

Mémoires sur les Principales Maladies de Enfans. Par le Dr. *Goelis*, 1st vol. 8vo.

At the annual transference of the Rectorship of the University at Leyden, the late Rector, Professor J. Van Voorst, D. D. delivered, on the 8th of February last, an Oration: "de commodis atque emolumentis, quæ e singulari Principum Europæorum, in profitenda, his temporibus, Religione Christiana, consensu, sperare et augurari liceat."

Dr. Granville is about to publish an Account of the Scientific Establishments of France.

London: Printed by W. Bulmer and Co.
Cleveland-row, St. James's.

Section of one of Mr. Thompsons Wells at Chelten

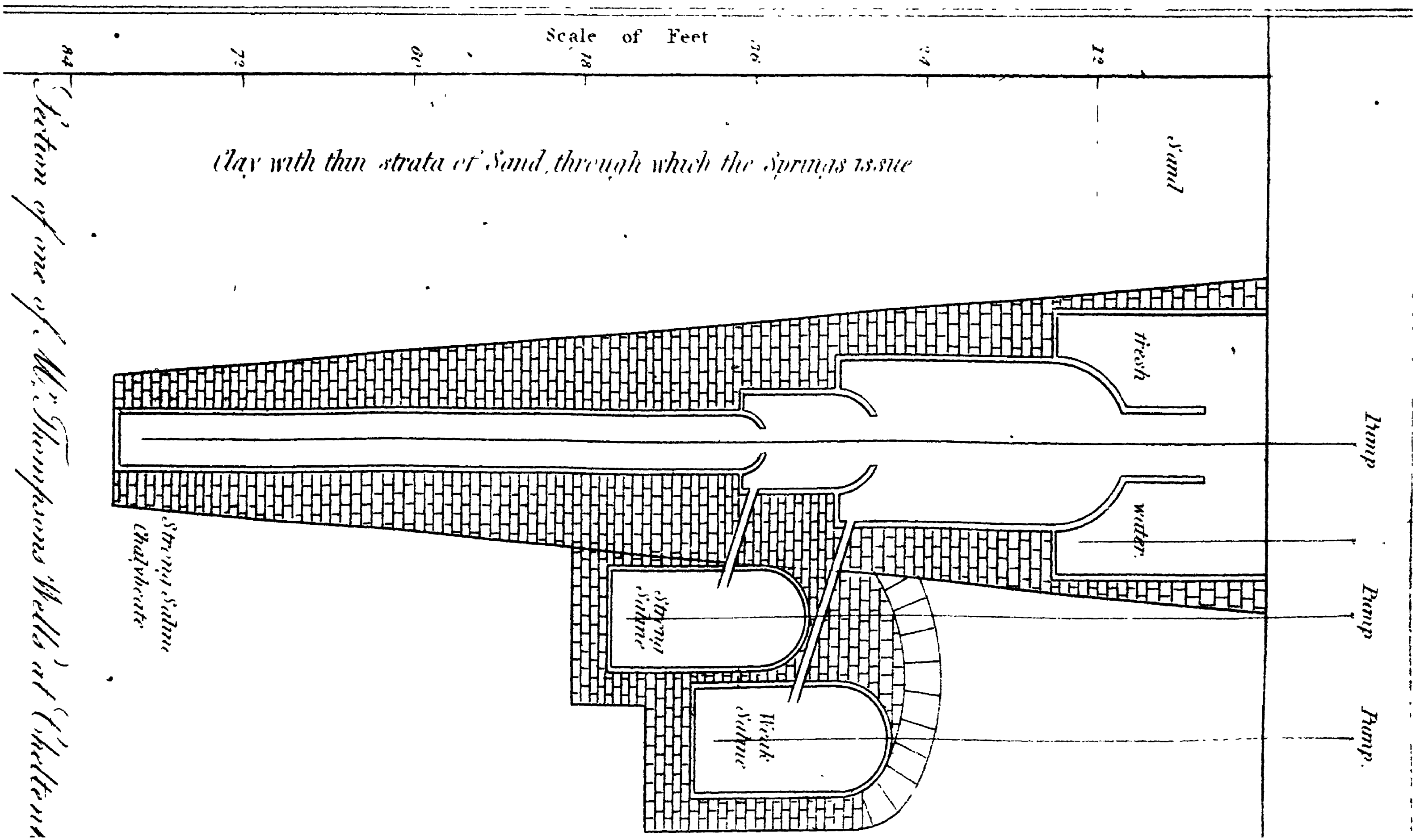


Fig. 1.

42	57	44	9	40	21	46	7
55	10	41	58	45	8	39	20
12	43	56	61	22	59	6	47
63	54	11	30	25	28	19	38
32	13	62	27	60	23	48	5
53	64	31	24	29	26	57	18
14	33	2	51	16	35	4	49
1	52	15	34	3	50	17	36

Fig. 2.

42	59	44	9	40	21	46	7
61	10	41	58	45	8	39	20
12	43	60	55	22	57	6	47
53	62	11	30	25	28	19	38
32	13	54	27	56	23	48	5
63	52	31	24	29	26	37	18
14	33	2	51	16	35	4	49
1	64	15	34	3	50	17	36

Fig. 3.

34	21	54	9	32	19	48	7
55	10	33	20	53	8	31	18
22	35	60	a	40	49	6	47
11	56	41	50	59	52	17	30
36	23	58	61	42	39	46	5
57	12	25	38	51	60	29	16
24	37	2	43	14	27	4	15
1	b	13	26	3	41	15	28

Fig. 4.

30	55	46	9	28	57	40	7
47	12	29	56	45	8	27	58
54	31	10	13	18	41	6	39
11	48	33	42	15	44	39	26
32	53	14	17	34	19	38	5
49	64	51	20	43	16	25	60
52	27	2	35	62	23	4	37
1	30	63	22	3	36	61	24

Fig. 5.

42	55	26	9	14	57	31	7
25	12	43	56	27	8	45	58
54	41	10	13	18	35	6	33
11	24	19	36	15	28	59	46
40	53	14	17	20	37	32	5
23	64	51	38	29	16	47	60
52	39	2	21	62	40	4	31
1	22	63	50	3	30	61	48

Fig. 6.

10	29	48	35	8	31	46	33
49	36	9	30	47	34	7	58
28	11	A	C	f	45	32	19
37	50	B	D	e	6	59	44
12	27	38	E	d	b	18	5
51	64	13	F	c	a	43	60
26	39	2	15	62	41	4	17
7	14	63	40	3	16	61	42

Fig. 7.

14	59	42	35	16	31	54	33
41	36	15	58	55	34	17	30
60	13	56	43	18	53	32	7
37	40	19	12	57	6	29	52
20	61	38	25	44	51	8	5
39	64	21	50	11	24	45	28
62	49	2	23	26	47	4	9
1	22	63	48	3	10	27	46

Fig. 8.

								33	
α	1	a	b	28	7	14	19	16	β
	24	27	8	c	20	17	6	13	
	9	2	25	22	11	4	15	18	
	26	23	10	3	d	21	12	5	

Fig. 9.

	37	62	43	56	35	60	11	50	
	44	55	36	61	42	49	34	59	
	63	38	53	46	57	40	51	48	
	54	45	64	39	52	47	58	33	β
α	1	26	15	20	7	32	13	22	
	16	19	8	25	14	21	6	31	
	27	2	17	10	29	4	23	12	
	18	9	28	3	24	11	30	5	

The Knights Moves at Chess.

THE QUARTERLY JOURNAL

OF

SCIENCE AND THE ARTS.

ART. I. *An Account of the Life and Writings of Baron* GUYTON DE MORVEAU, *F. R. S. Member of the Institute of France, &c &c.—By* A. B. GRANVILLE, *M. D. F. L. S. M. R. C. S. &c. Foreign Secretary of the Geological Society.*

MORE than twelve months have elapsed since Guyton Morveau, a man known throughout Europe, paid the great debt of nature; and no friendly hand, no admiring follower, has been permitted to trace the page, which is to belong to him in the history of revolving ages. Duty on some of them, affection on others, might have imposed the pleasing task; but both are silent; and he who adorned the rank of a citizen—the post of a magistrate—the chair of a professor—and the more glorious character of a friend to humanity—has passed away like the traveller, who having quitted the populous and busy town, is soon forgotten by his merry companions. A few days more, and perpetual banishment from his native country, would have darkened the anniversary of his 80th year; for Guyton belonged to other days—to days of revolutionary efforts; and to such the time of retribution had arrived at the epoch of his dissolution. Hence the silence of all, save the murmurs of a few friends, and the plaintive sorrow of his disconsolate widow.

These circumstances have induced me to collect in the following pages, from good and authentic documents, such

particulars concerning G. Morveau as deserve to be rescued from oblivion.*

Louis Bernard Guyton de Morveau was born at Dijon, on the 4th of January 1737, of Anthony Guyton and Marguerite de Saulle. His father, Anthony Guyton, professor of civil law in the university of Dijon, was descended from an ancient and respectable family. His great grandfather had served as chief surgeon in the battalion of the "*cent hommes*," under the Duke de Bellegarde in 1629.

Young Guyton's early education was not neglected. But while his father and his tutor were initiating him in the old routine of theories, nature taught him to resort to the practical acquisition of knowledge. Accustomed every day to see the various artificers, whom his father employed about his house, to satisfy a caprice for building, young Guyton insensibly caught the spirit of mechanics. At the age of seven he had already given many instances of a disposition for that branch of philosophy; and this, which was in him improperly considered as a natural inclination, was the incontestible effect of example. Being with his father at a small village near Dijon, during the vacation, he there happened to meet a public officer returning from a sale, whence he had brought back a clock that had remained unsold, owing to its very bad condition. Morveau begs and supplicates his father to purchase it; six francs were given—the clock was dismounted and cleaned by the ardent boy—some pieces that were wanting were added—the whole put together as before, without any other assistance; and in 1799, that is, fifty-five years afterwards, the clock was resold at a higher price, together with the estate and house in which it had been originally placed; having during the whole of that time preserved its movement in the most satisfactory manner. The same operation he once undertook for his mother's watch, to her perfect satisfaction, though he was then only eight years of age.

* I am happy in this opportunity of acknowledging the liberal and friendly assistance which I have received from Madame Morveau, and from several of the early and intimate friends of her deceased husband.

These trivial details might be multiplied; but they might also appear tedious and unimportant; they have been mentioned to shew how impossible it is to predict from the early whims of childhood, the vocation which is to engage any individual at a more advanced period of life. No one has shewn less taste for mechanics than Guyton, during his long and brilliant career.

After the first years of instruction under his paternal roof he was sent to college, where he finished his studies at the age of sixteen. About this time a M. Michault, a friend of his father, and a naturalist of some merit, proposed to instruct him in botany. Among his companions in this study was Guyette, who was intended for the church, and who, while engaged in theological studies, was often severely reprimanded by the rector, for having in his cell the works of Linnæus! Such were then the liberal ideas of the French clergy. After having passed through all the dangers of the subsequent revolution, Guyette was poisoned by his maid-servant, who was afterwards tried, convicted, and executed

Having now acquired greater maturity of understanding, young Guyton was admitted a law-student in the university of Dijon, and after three years of close application, was sent to Paris to acquire a knowledge of practice at the bar.

The more sober studies of the law, however, did not prevent him from cultivating various branches of polite literature, on which subjects he corresponded with several friends who were eminent in the belles-lettres.

A visit which he paid to Voltaire in 1756, at Ferney, seems to have given him, at one time, a turn for poetry; particularly of the descriptive and satiric kind. We might instance the agreeable poem which he composed a year afterwards, when only twenty, called "Le Rat Iconoclaste," * of which a new edition was published a few years before his death. It was intended to throw ridicule on a well known anecdote of the

* *Le Rat Iconoclaste*, ou le *Jesuite croquée*. Poëme heroi-comique, en vers, en six chants, 1763, without name of place, pp. 55, large 12mo.

day, and to assist in quickening the fire, that already threatened destruction to the obnoxious order of Jesuits; but circumstances did not permit of its publication till after that order had fallen, as it was then hoped, never to rise again. Copies, however, were freely circulated in 1757.

The adventure which furnished the subject for the author's mirth, was pleasant enough. Some nuns who felt a strong predilection for a Jesuit their spiritual director, were engaged in their customary Christmas occupation of modelling a representation of a religious mystery, decorated with several small statues representing the holy personages connected with the subject; and amongst them that of the ghostly father; but to mark their favourite, his statue was made of loaf sugar. The following day was destined for the triumph of the Jesuit; when it was discovered that some sacrilegious hand had pilfered the valuable puppet. A rat had, in fact, demolished the delicious morsel.* The poem is written after the agree-

* It may, perhaps, be worth while to give here some short extracts. We select the passages describing the installation of the *sweet image* by one of the nuns in the presence of the sisterhood; and the subsequent sacrilege.

" Echarpe en main, cependant, soeur Elie
Saisit déjà le directeur sucré,
Le montre à tous, et d'un pas mesuré,
Par le respect et la cérémonie,
Va le porter près du berçeau sacré;
Elle l'y place, et tandis qu'on l'admire
Que sur lui seul tombent tous les regards,
La mère Icare achève, sans mot dire,
Et d'une main que le Dieu des hazards
Guidoit, d'accord avec l'impatience,
Place à la hâte et Nonains et Frocards:
Plus d'examen, plus de préférence.
Tel un joueur, lorsque sur l'échiquier
Il a rangé les pièces principales;
Le roi, d'abord, le fou, le cavalier,
Celles enfin aux marches inégales;
Il prend les pions, et sans autre dessein,
Prèfére ceux qui tombent sous sa main."

able manner of the more celebrated and inimitable poem—Ververt; and contributed to the ridicule of the order. At the time of writing this ¯poem, M. Guyton was far, perhaps, from thinking, that at no very remote period, he should be

¯ The Goddess of Vengeance, fired with indignation at the above profane ceremony, after having devised a thousand schemes to punish the criminal sisters; seeing a *certain gros rat,* who had just emerged from his hole, spurs him on to the deadly act in the following manner:

"Toi, qu'en ce lieu le Ciel même a conduit,"
Dit-elle alors à la bête vorace,
"De mon corroux pour être l'instrument,
Digne héritier des vertus de ta race,
Arrête, écoute, et sers moi promptement;
Si jusqu'ici ce respect fanatique,
Que tant de fois aux crédules humains,
Fit éprouver l'ouvrage de leurs mains,
N'a point glacé ton courage héroïque,
Cours, hâte-toi, sous ton avide dent
Tombe à mes yeux ce Colosse impudent:
Faut-il encore que l'intérêt t'anime?
Hé bien, aprens, que c'est un met exquis,
Qu'il est tout sucre; et que dans ta victime
Des tes exploits tu trouvera le prix.
A ce discours, le rat dressant l'oreille,
Fixe de loin cette sainte merveille,
Pousse des cris que peignent le desir,
Quitte son trou, part, et court l'assouvir.
O triste sort des terrestres ouvrages!
Ce Benjamin, cette idole des coeurs,
Dressée exprès par de ferventes soeurs
Pour recevoir leur plus tendre hommage,
Sert de pâture au plus vil animal!
A coups de dent, sappant son piedestal,
L'Iconoclaste aussitôt l'terrasse;
Il brise, il croque, il ronge avec ardeur,
De tous côtés entame la surface,
Grignotte, souille . . . Hélas! ce beau pasteur
N'est bientôt plus qu'une grossière masse,
Dont l'air hideux inspire de l'horreur
Et qui dement son antique splendeur!"

called upon to plead openly against the Jesuits. But this was not the only essay of our young poet. Many are the fugitive pieces which his pen produced, and amongst his papers we find several fragments of tragedies, some of which make us regret that he did not complete them, before he was prevented by the more serious occupations of his profession.

At the age of twenty-four, Guyton had pleaded several important causes at the bar, when the office of advocate-general at the parliament of Dijon, was advertised for sale. It is well known that all public situations, even of the greatest responsibility, were then sold in France, to the best bidder. Guyton's father having ascertained that this place would be acceptable to his son, purchased it for forty thousand francs. The reputation of the young advocate, and his engaging manners, concurred in facilitating the bargain; and it is perhaps worthy of remark, that when his father presented him to the parliament on that occasion, the magistrates composing it, after many flattering compliments, expressed a fear that his health, which seemed delicate, would suffer from the fatigues of office. In looking over some of his notes we find the following remark, made in 1814, on this prognostic: "Quand je relis cette note à l'age de 77 ans accomplis, et que je passe dans ma mémoire les différentes carrières que j'ai parcourues dans les lettres, dans les sciences physiques, les cours publics, les fonctions administratives et legislatives, les commissions aux armées, academiques, &c. je ne puis m'empêcher de rire du prognostic des amis de mon père."

In 1764 Guyton was admitted an honorary member of the Academy of Sciences, Arts, and Belles Lettres of Dijon, then one of the most learned societies of Europe: and here begins that brilliant career, which he followed with so much ardour and glory.

Two months afterwards Guyton presented to the assembled chambers of the parliament of Burgundy a MS. memoir on public instruction, with a plan for a college, on the principles detailed in his work.* When we consider the youth of the

* This Memoir, together with the prospectus, was printed in the same year, at Dijon, in a small 12mo volume, pp. 324.

writer, the age he lived in, the prejudices he encountered, and the deeply rooted abuses he had to combat, we cannot help admiring the talent displayed in this work, and wishing that its principles had never been lost sight of in arranging the systems of public education. The encomiums which every public journal of the time hastened to pass on this production, and the flattering letters which he received were proofs of its value.

The celebrated Chalottes, who was the king's attorney-general at the parliament of Bretagne, and who had treated the same subject in a masterly manner, wrote to him as follows: "J'ai prouvé la nécessité de la reforme de l'éducation publique; vous avez indiqué les moyens de l'exécuter."

It was in this memoir that Guyton first endeavoured to prove with Locke, Quintillian, and La Bruyere, but with arguments as strong and convincing as they were new, the principle, which he had afterwards to defend against a colossal philosopher of those days, "that *man is bad or good according to the education he has received.*" The inverse assertion had been advanced by Diderot, in his "*Essai sur la Vie de Sénèque.*" He there says, "*que la nature fait des méchans, que les meilleurs instituteurs ne peuvent rendre bons;*" but M. Morveau, in a letter to an anonymous friend, successfully exposed the fallacy of this argument.*

It is much to be questioned, whether any other work will be found to contain, in so small a compass, so many valuable observations, founded on such just and novel principles. The question of public education is treated in a liberal and open manner; and though at that period, no traces of any inclination for the study of the exact and natural sciences could be perceived in Guyton, yet it is curious to see the ideas he had already formed of the method by which those sciences ought to be taught and learned.†

---

* The letter was entitled, Sur l'Influence de l'Education publique, A Mons. J. Z. printed 1782.

† "La physique," says the author, "est de toutes les parties de la philosophie celle qui a le plus besoin de réforme; mais elle est, en même tems, celle où il sera plus facile de l'introduire; dès que l'on sera d'accord de l'enseigner en langue vulgaire et sans *ergote-*

A few months after the publication of this essay, Guyton delivered an *Eloge* on the President Jeannin, at a public meeting of the Dijon academy: it was full of chaste eloquence, and virtuous sentiments.*

But in following such a man through the various epochs of his active and industrious life, we should fill volumes, were we to allow ourselves to deviate from the principal point in view. We, therefore, pass over all the circumstances of minor importance, and hasten to the brilliant chemical career which he first entered upon at the age of thirty, when deeply plunged in the intricacies of a very different pursuit.

The exact sciences were so ill taught, and lamely cultivated, at the time of Guyton's university education, that, after his admission into the academy of Dijon, his notions of mechanical and natural philosophy were scanty and insufficient. This partial ignorance exposed him to some mortification during the meetings of that society A Dr. Chardenon was in the habit of reading memoirs on chemical subjects; and on one occasion our author thought it necessary to hazard some remarks which were ill received by the Doctor, who sneeringly told him, that having obtained such success in literature, he had better rest satisfied with the reputation so justly acquired, and leave chemistry to those who knew more of the matter.

Angry at this virulent remark, Guyton determined upon an

ries, il n'y aura plus à craindre que l'on perde un tems aussi considérable à la physique générale; étude vraiement digne du tems où l'on croyoit que la nature ne pouvait agir que suivant les principes d'Aristote, et qui n'était, au fond, qu'*un langage dont on était convaincu pour exprimer en termes scientifiques ce que tout le mond sçait*. Tout ce travail aussi ennuyeux qu'inutile, se trouvera bientôt reduit à l'explication préliminaire de quelques mots qui sont d'un usage fréquent; on cessera d'argumenter aussi longtems sur la definition de la physique, sur l'essence de la matière; ce ne sera plus par des *raisonnemens généraux*, *mais par des observations* que l on faira connaitre les phenomènes que présentent les corps," &c.—See Mémoire sur l'Instruction publique avec le prospectus d'un collège &c. Dijon, 1764, 12mo.

* Eloge du President Jeannin. Paris, chez Simon, 1666.

honourable revenge. He therefore applied himself to study the *theoretical and practical Chemistry* of Macquer, and the *Manual of Chemistry* which Beaumé had just published. To the latter chemist he also sent an extensive order for chemical preparations and utensils, with a view of forming a small laboratory next his office.

Having done this, he began by repeating many of Beaumé's experiments; and by trying his inexperienced hand in performing original researches he soon found himself strong enough to attack the Doctor. The latter had just been reading a memoir on the analysis of different kinds of oils, when Guyton proceeded to combat and controvert some opinions in so forcible and masterly a manner as astonished every one present. The meeting having been adjourned, Dr. Chardenon addressed Guyton. "Sir," said he, "you are born to be an honour to chemistry. So much knowledge could only have been so quickly gained by genius joined with perseverance. Follow your new pursuit, and confer with me in your difficulties." Such is the language of a liberal man, who ambitious without jealousy, and loving science for its own sake, sees in the laudable efforts of another, nothing but an additional means of forwarding the progress of his favourite study.

The fresh pursuits of Guyton did not prevent him, however, from continuing to cultivate literature with success. The French Academy had proposed for the subject of an *Essai* the *Eloge* of Charles the V. of France surnamed the *Wise*, and Guyton was one of the candidates.* A few months afterwards, at the opening of the session of parliament, he delivered a discourse on the actual state of jurisprudence, on which subject, three years later, he composed a more extensive and complete work.† No code of laws demanded reform more urgently than those by which France was, at that time, we will not say governed, but distracted. Every class felt the necessity of such a reformation, even as far back as 1767, and Guyton, in the course of

* This Essay was printed at the time, without the author's name, and reprinted in 1775, at Paris, in the 2d volume of his Eloges, &c.

† See the above work, t. 1, p. 47.

his peroration to the Parliament, on the above occasion, proved this necessity from the multitude and contrary tendency of endless laws, in themselves incoherent, whose commentaries, far from rendering any service to the public, made their study more intricate, and their application more arbitrary. These remarks led him to form a wish, which he often expressed, and indeed repeated in a preface to another of his works on jurisprudence,* that a time might come for the formation of a national code. This desire he had the satisfaction of seeing accomplished long before his death; and that satisfaction must have been not a little heightened, when he reflected that, he had several years before foreseen the happy change he contemplated.† A letter by which Voltaire thanked him for a copy of his work forwarded to Ferney, shews the opinion of that celebrated writer upon this production.

Chance, which led Guyton to become a chemist, was also favourable in procuring him the means of forming a laboratory, at a very moderate expense, and with little trouble. A young gentleman of Dijon, seduced by the promises of the adepts, had taken into his house, as instructor in the secret art, one of those itinerant alchymists, who wandering about the world in tatters, asked for an alembic and a furnace only to produce the precious metal. After six months of expensive and

---

* Plaidoyers sur plusieurs Questions importantes de Droit canonique et civil. Par M. Guyton de Morveau, Avocat General. Dijon, 1785, 4to. pp. 677.

† "Cependant j'ai encore plus à cœur de conserver l'espérance qu'un jour nos loix remises dans un meilleur ordre, séparées, comme je l'ai dit ailleurs, d'après l'illustre Montesquieu, de cette multitude de loix mortes, dont le gangrène dévore incessamment les loix vivantes, plus assorties à nos mœurs et aux lumières de notre siècle, purgées de ces usages qui n'ont que l'autorité d'un abus invétéré et dont la contrariété est un scandale pour la raison; réunies enfin dans un *Code National*, portant à la fois l'empreinte de la sagesse et de la puissance, feront tomber en oubli cette immensité des volumes où les grands esprits n'ont peu qu'errer dans le labyrinthe des opinions, faute de trouver une opinion consacrée par la législation." Préface aux Plaidoyers, &c. p. v.

tedious operations however, during which time the roguish professor had contrived to distil many essences and balms, which he secretly sold for his own profit—the gentleman, beginning to doubt the sincerity of his instructor, dismissed him from his service, and went to drown his folly in the dissipations of the capital; leaving to Guyton his apparatus and materials for a trifling sum.

In July of the same year Guyton went to Paris, for the purpose of visiting the scientific establishments of that metropolis, and purchasing books, preparations, and instruments, which he still wanted to enable him to pursue his favourite study. The person to whom he addressed himself for this purpose, was Beaumé, who was then among the first of the French chemists.* Pleased with Guyton's ardour, Beaumé proceeded to inquire what courses of chemistry he had attended. None, was the answer. How then could you have learned to make experiments, and above all to acquire the dexterity which certain manipulations require, and which you seem perfectly to understand? Practice, replied the young chemist, has been my master; melted crucibles and broken retorts my tutors. *In that case,* said Beaumé, *you have not learned, you have invented.*

Guyton's first essay on his return to Dijon, was presented in a note which he read to the Academy that same year, but which, not having been printed, has probably been lost.† His next memoir was of more importance.

The phenomenon of the increase of weight in metals after a long exposure to the action of fire, had been, in fact, explained by Jean Rey in 1630; but lost sight of almost immediately afterwards. His explanation was forgotten, and the *calcination* of metals became once more the subject of controversies and conjectures amongst the successive philosophers who cultivated the science of chemistry. Dr. Chardenon,

* In the note of the different articles purchased by Guyton, we find half a drachm of platinum charged 10 francs, which is now sold in Paris for 15 francs per ounce, worked.

† *Observation sur une Végétation métallique artificielle.* Lue à l'Academie de Dijon.

who had often observed this augmentation of weight, attempted to explain it in a memoir, which he read at the Academy of Dijon.* He began by shewing the improbability of the hypothesis advanced by others; and particularly combated that of M. Berault, who in a memoir, which obtained the prize of the Academy of Bordeaux, twenty years before, had imagined that the air surrounding the ignited metals, deposited amongst their molecules, a quantity of foreign matter, and thus encreased their absolute gravity. The new explanation, however, which Dr. Chardenon offered, was not much happier; and it certainly must strike us with astonishment, that men otherwise instructed, and versed in the physical sciences, should have so far perverted their own knowledge, as to explain a phenomenon, consisting in the *augmentation* of absolute weight in a given mass, by imagining the *subtraction* of a certain principle from that mass; and vice versa the *reduction* of its primitive weight, by the *addition* of the same principle.†

Anxious to prove his interest in the new study he had embraced, Guyton lost no time in pursuing this inquiry, and, a few months afterwards, read a paper upon the subject.‡ That spirit of practical research, which has distinguished the writer on every subsequent occasion, seems to have dictated this production; but in those days no appeal to facts could produce conviction.

In April of the following year, while making some experiments on the solution of alcalies in certain acids, Guyton was very near collecting the carbonic acid, by saturating a given quantity of mineral alcali (carbonate of soda) with nitrous acid. But his aim in making these experiments, was to shew that, during the effervescence which took place at

---

* Mémoire sur l'Augmentation de Poids des Métaux calcinés. See Mém. de l'Acad. de Dijon, tom. i. p. 303.

† Dr. Chardenon asserted that the *abstraction* of what was then called phlogiston, and in which, according to the Stahlians, the calcination of metals consisted, was sufficient to account for the *increase* of *weight* they acquired during that operation.

‡ See Mémoires de l'Academie de Dijon, vol. i. p. 416. Sur les Phénomènes de l'Air dans la Combustion.

the moment of mixing the two ingredients, there was a considerable diminution of the temperature.*

We prefer thus shewing, in their true colours, the first attempts made by Guyton in pursuit of a science in which every thing was yet to be created, and to which he came unprepared, and assisted merely by his own genius and an ardent desire for knowledge. By thus following him progressively, through the various periods of his chemical career, we shall obtain two important and beneficial results. We shall, in the first place, be forced to retrace the history of modern chemistry through its various epochs, his name being attached to all by the progress he himself made in that science; and next derive from such a sketch a sufficient motive for emulation.

But it must not be supposed, because Guyton had ardently embraced pursuits foreign to his professional vocations, that he neglected the field of literature, in which he had culled so many flowers; or that he abandoned the bar, which resounded still with his praise. By an assiduity that has few examples, a zeal that knew no bounds, Guyton was alternately a chemist, a magistrate, and a distinguished writer of polite literature. At the opening of the sessions of the parliament of Burgundy, in November 1769, he pronounced a discourse, "*sur les mœurs*," which was as remarkable for the beauty of its style, as for the soundness of its doctrine. This oration served to confirm his talents as a chaste and elegant writer—a character which he has maintained even in the course of the most unimportant, as well as the most abstruse memoirs on subjects of science.†

A year after the epoch of which we are speaking, a great portion of a hanging wood stretching itself along a plain situated at the height of 60 or 80 feet above the village of Trouhaut, having fallen, and thereby created considerable alarm, Guyton was commissioned by the Academy, with his

---

* Observation sur une Effervescence froide. See Mém. Acad. of Dijon, vol. ii. p. 183.

† See Discours publics, Eloges, &c. 3 vol. Dijon et Paris, 1775, tom. i.

colleague M. Picardet, to give an account of the event to the society. His report was read, and printed in their Transactions; with an additional observation on a deep cavern called the *Creux de Francheville*, which had given rise to many popular superstitions in the neighbourhood.

Various other occupations distinguished the next four or five years of Guyton's life, in his double capacity of a chemist and a lawyer; but in a sketch like the present, in which his most important labours only can be recorded, it would be needless to dwell upon all his productions * We must not, however, omit to mention the collection of scientific essays, which he published about this time, and in which he treated some of the most important subjects connected with science—and this in despite of some of his prejudiced legal colleagues, who publicly upbraided him for giving up too much of his time to scientific researches.†

When we reflect on the state of chemistry and the physical sciences in France, at the time Guyton was composing his essays, we cannot help admiring the talent, which alone and unassisted, could produce the memoirs on phlogiston, crystallisation, and the solution of salts, found in that miscellany. But we are more astonished at the results this extraordinary man obtained in making some experiments, the purport of which had been suggested to him by the celebrated naturalist Buffon, and which tended to ascertain the time employed by

* We shall merely mention the title of some of his memoirs written and published during that lapse of time.

Manière d'éprouver les charbons de pierre par la cèmentation. Dijon, 1769.

Réflexions sur la Boussole à double aiguille. Dijon, 1771.

Hauteurs barometriques prises aux Environs de Dijon, 1771.

Consultation Juridico-chimique sur la Question de savoir si le charbon fossile est un fruit de la terre renaissant, qui puisse donner lieu à l'action en retrait lignage (contract void) 1771.

Plaidoyer dans une cause où il s'agit de fixer l'époque de démence du Testateur pour prononcer sur la validité d'une donation, 1772.

† See Digressions Academiques, ou Essais de Physique, Chimie, et Histoire naturelle, &c. Dijon. 12mo. 418 pages, 1772.

different substances, in absorbing and emitting a given quantity of heat. The theory of caloric was so far from being understood at that time, that to compare those results with the more modern doctrine, would be to proclaim their condemnation ; still it will be allowed, that in devising and executing the experiments in question, he shewed himself, even at that remote period, worthy of our more enlightened days. He employed globes of different metals in their purest state, and the results are recorded in his *Journal of Chemistry*, a register which he kept of every chemical operation executed in his laboratory.

In one of the volumes of his literary productions, we find an Eloge, which he pronounced in 1772, on the president Bouhier, a magistrate of the soundest integrity, and a man of eminent virtues, of whom his biographer relates that, being within a few moments of his dissolution, and importuned by an attending priest, who wished him to proceed to the auricular confession, said, sir, I cannot . . . . . I am busy . . . . "*j'épie la mort*." The accuracy with which Guyton recorded this fact, cost him many insulting attacks he had afterwards to endure on the part of a religious hypocrite, at a time when bigotry and superstition had reached that acmé which called for immediate reformation.*

In a dissertation in defence of the theory of phlogiston,† then attacked by several eminent men, we find another instance of the accuracy of M. Guyton's mode of making experiments. That theory was ultimately overthrown by the labours of many of our countrymen and of the illustrious Lavoisier ; but the facts relative to combustion, the calcination of metals, and the increase of weight resulting from it, observed and recorded by Guyton in that dissertation, have not only withstood the shock of that mighty fall, but were afterwards admitted by the latter celebrated reformer of chemistry, as some of the best proofs of his new doctrine.

* See the edition of the works of President Bouyer, by the President Bevy, in 1787.

† Défense de la Volatilité du Phlogistique, &c. Paris. 12mo. 40 pages.

Every one knows, that amongst the maladies with which humanity is afflicted, none is more exquisitely painful than the one caused by those singular concretions, formed, we know not how, in some of the vessels destined to receive the secreted bile from the liver. It is to the presence of these calculi, that we must ascribe a certain peculiar morbid affection, often attended with danger, and always alarming. Mons. Durande, a physician of high repute at Dijon, having in vain sought to alleviate the symptoms of that disease, applied to Guyton for advice; and as it generally happens, that when a science, almost new, acquires considerable reputation, its applications are very often supposed to be more numerous than the science itself will allow, it was imagined, that if a solvent of these calculi could be found in a chemical laboratory, their solution in the animal organs would no longer be an enigma. With this view of the subject, Mons. Morveau proceeded to try the action of all the chemical agents he had in his possession, on the biliary calculi of all sizes and colour which his friend Durande had supplied him with; and actually found that æther produced the quickest, as well as the most complete solution of those concretions. But the question now arose, how to extend in any effective manner, the beneficial action of that extremely volatile substance to the biliary ducts, there to attack the cause of the malady? M. Durande thought he had resolved the problem by uniting the æther with spirit of turpentine; and many are the cases of complete success, which are recorded in his own practice, and in that of more modern physicians, by means of this application.

This and the following* year of Guyton's life, were particularly rich in useful and ingenious researches. His experiments on adhesion are too well known to need particular mention in this place. The results he had obtained from them were afterwards confirmed by other philosophers, who, like him, found, that a disk of glass, ten lines in diameter, adhered to the surface of mercury with a force equal to a weight of 66.5 grains.

* 1773-74.

About this time, the theory of gases was beginning to threaten the phlogistic doctrine. The researches of several eminent philosophers of Europe, and more particularly of England, had brought the two parties to a close combat, from whence there was no retreating, unless either conquered or triumphant. Guyton took part in the contest, and perceiving the weak side of the doctrine he had hitherto supported, without however being yet wholly convinced of the soundness of that of his opponents, in a publication, which does him infinite credit,* and in which his theories and conjectures are supported by new facts and experiments, shewed a disposition to adopt the pneumatic doctrine, provided several doubts were explained to him, which yet perplexed and forbade him to embrace its otherwise luminous principles.

We shall pass over in silence the connections which Mons. Morveau established, about this time, with two men equally illustrious, but not equally fortunate. With the one, Buffon, his intercourse was either scientific, or relating to some manufactures which that eminent naturalist had established; with the other, Mons. Malesherbes, his friendship was founded on that mutual esteem, which sympathetic minds, equally alive to the beauty and importance of literature, feel for each other. The former died, after a brilliant career, surrounded by his numerous friends, and cheered by the futurity of a lasting reputation; the latter, after a chequered existence, fell within the whirlwind of the revolution, and was hurried along with its torrent to destruction, one of the numberless victims of that extraordinary event.

Guyton was still attorney-general at the parliament of Burgundy, where he had just pronounced a discourse on firmness of character,† when an ardent desire of doing yet more for chemistry, suggested to him the idea of giving a public course of lectures on that favourite science, in his native city. An application was therefore made to the proper

* Reflexions sur le Parallèle du Philogistique et du Causticum, &c. Dijon, 1773.

† See Recueil des Eloges, et Essais et Discours, &c. Paris, 3 vol. 1782.

authorities, the permission obtained, and the necessary funds for supplying a laboratory granted. From this moment our magistrate prepared himself to exercise the functions of a professor.

But before appearing in his new capacity, M. Morveau was destined to lay the foundation of a most important discovery. We allude to his mode of disinfecting air impregnated with pestilential or epidemic miasmata. It was in 1773 that Guyton shewed the efficacy of muriatic acid gas in destroying infection. Till then, no scientific principle had led those who in vain sought to combat the influence of that infection in hospitals, lazarettoes, prisons, or otherwise, where it produced the most fatal consequences, to the discovery of any effective method. Means, as various as they were numerous, had till then been employed with little success. The aromatic fires, the combustion of sulphur, the acetic vapours, and others, had never been productive of any beneficial effect; and the infection which had spread itself, at the epoch we are now recording, in one of the churches at Dijon, would have ultimately proved fatal to that city, as it had hitherto proved unconquerable, had not Guyton, led by analogies which his chemical researches had suggested, proposed and employed the gas resulting from the decomposition of muriate of soda by sulphuric acid. In this manner was that church instantly purified; and thus were the prisons of Dijon during the same year entirely freed from the infectious fever, springing from the accumulation of diseased persons. From that moment it was proved, that the muriatic acid gas attacked and destroyed the baneful effects of putrefaction, no matter how produced, by which the most trivial malady is often changed into a disease of fatal termination. At a subsequent period, Fourcroy, from a supposition that the gas in question acted in virtue of the oxygene it was believed to contain, suggested to employ it, in that state in which a much greater proportion of that same principle was supposed to be present. Guyton, who, without entering into the theories explanatory of the effect, contented himself with the important results to be derived from it, having ascertained by comparative experiments the

superior efficacy of the oxygenated muriatic acid (chlorine), proposed by Fourcroy, in certain cases, lost no time in adopting the improvement; and thus established at once, in the most incontrovertible manner, one of the most powerful means with which the magistrate, as well as the physician, can arm themselves to combat infection. The subsequent proposition made by Dr. Smith to the British Government, of employing nitrous vapours, cannot fairly be said to come in competition with Guyton's method. The use of acid gases, to purify infected places, was incontestibly proposed in the first instance by the latter chemist; and as to the superior efficacy of the muriatic acid, and consequently of chlorine over the nitrous fumigations of our countryman, the question has been long ago decided by the popular voice of every impartial and well qualified judge in such matters. We cannot, therefore, hesitate in placing Guyton amongst the few men who have well deserved the civic crown due to the friends and benefactors of humanity.

The 29th of April, 1776, was, without doubt, a day of triumph for science. To see a chief magistrate, whose eloquence had often thundered terror into the conscience of the most obdurate criminal, and at whose voice drooping virtue had raised her dejected spirits, now disrobed for a moment of the insignia of his office, enter the amphitheatre of the Academy, whence he proclaimed the principles of that most important and most seducing of all sciences—chemistry—which he was born to promote and to illustrate. At a period of so much doubt and confusion, when the oldest and the most eminent professors of chemistry could not agree amongst themselves in the adoption of particular theories and the order of demonstration, who could have expected much luminous simplicity of doctrine with a clear and convincing series of experiments, either to support it or to render it plausible, in a simple *amateur*, who had but just initiated himself into the mysteries of that science, confined to the chief town of a province? Yet this is what we collect from the concluding Discourse, with which M. Guyton closed his first course of Lectures. "Nous avons d'abord," says he, "mis sous vos yeux les substances

naturelles, simples ou composées; nous vous avons fait connaître les proprietés de leurs principes, celles qu'elles acqueroient, celles qu'elles perdoient par composition ou décomposition; les moyens de la nature pour opérer ces changements; les procédés de l'art pour mettre en jeu les moyens de la nature, et les avantages que nous procuroient ces connoissances." We should in vain be looking around us, in our days, for a clearer exposition of what may be done in publicly teaching chemistry. Happy indeed the modern pupils whose professors can say with Guyton at the close of his labours, "Nous ne craignons pas que vous nous reprochiez de vous avoir égarés, dès les premiers pas, par une fausse théorie; *nous avons abandonné nos propres opinions*, toutes les fois qu'elles étaient susceptibles de quelque controversie; nous sommes convenus de bonne foi de l'insuffisance de l'art, sur les choses qu'il n'a pu expliquer d'une manière satisfaisante; sans invoquer ces causes occultes qui ont été de tout tems la ressource de l'ignorance présomptueuse."

We insist the more on these details, because that part of Guyton's life which was passed at Dijon, is that which is least known, we will not say in England only, but in France, where any thing that is done in the country seldom attracts the attention of the capital, so as to form the reputation of an individual, who has not the good fortune of being associated to the great institutions of the metropolis, however superior he may be in all respects to many of their members.

But the fame of Guyton could no longer remain confined within the limits of a few country towns. His zeal and talents; his erudition and extensive knowledge; his proficiency in the natural sciences; the eloquence of his harangues, and the elegant style of his writings; to which may now be added, the utility of his chemical lectures, gratuitously delivered, were too powerful motives for rendering him truly popular and extensively known in France, not to attract the attention of the most renowned of his countrymen, as well as that of the most eminent and learned men of Europe. Yet as increasing merit never fails to meet with unworthy opponents, Guyton had, like many other illustrious persons, the mortifi-

cation of seeing himself attacked by prejudice on the one hand, and by malice and open hostility on the other. *Fixed air*, since called *carbonic acid*, was at that time engaging the attention of chemists, and Guyton had thought it necessary to exhibit some experiments illustrative of its properties, when several writers, amongst whom were many medical men, attacked the principles on which the nature and properties of that acid were explained, insisting upon its identity with the vitriolic acid. Guyton, however, in two essays, completely refuted the doctrine.

Another source of controversy was the establishing metallic conductors at Dijon, at a time when they had just been proposed by the American philosopher. Guyton's efforts in seconding the benevolent intentions of that illustrious man, were considered as irreverent and irreligious : he was attacked for his *presumption*, in disarming the hand of the Supreme Being ; and would have suffered materially from the multitude of fanatics who had assembled to pull down the conductor placed on the house of the Dijon Academy, had not Dr. Maret, the secretary, succeeded in dispersing the motley troop, by assuring them that the astonishing virtue of that instrument resided in the gilded point which had purposely been sent from Rome by the Holy Father. Thus we see, how, even in the heart of the country, France had already begun to exhibit that strife between philosophy and prejudice, between good sense and ignorance, which ended in the complete triumph of the former.

In 1778, M. Guyton published the first volume of a Course of Chemistry, which shortly afterwards was succeeded by a second, a third, and a fourth volume.* Our present knowledge of this science is such, that we could not refer to this work with a view of deriving any material information from it. The important and astonishing progress made since that time in chemistry, and to which Guyton himself has been greatly

---

* Elémens de Chimie théorique et pratique dans un nouvel ordre d'après les découvertes modernes pour servir aux cours publics de l'Academie de Dijon, 1777, 4 v. 12mo.

instrumental, have rendered all former productions mere works of reference; wherein we may trace the first steps of that gigantic march which chemists have since performed, in pursuing philosophical truth. As a monument, therefore, of the early efforts of Guyton in behalf of his favourite science, and of the extraordinary versatility of his talents, his Elements of Chemistry will always be referred to with considerable satisfaction.*

The pleasing and desultory part of the science, however, was not the only one that Guyton cultivated. Aware, from his every day increasing knowledge of new and interesting facts, that they were applicable to various objects of public and domestic life, and that they might thus be rendered highly important to society, he studied the different modes of their applications; and amongst other enterprises of which we cannot here undertake to speak, the establishment of a manufacture of nitrate of potash, on a large scale, ought more particularly to be mentioned. This enter-

* When this work first appeared, the approbation of every eminent chemist met it from every quarter. The predecessor and instructor of Fourcroy, Bucquet, Professor of Chemistry at the Jardin des Plantes, wrote to him in the following manner: "J'ai lu les deux derniers volumes de vos Elémens de Chimie avec le même plaisir, et lemême intérêt que j'avais eprouvé en lisant les premiers; la science vous est redevable, non seulement d'une infinité d'expériences bien faites et absolument neuves, mais aussi de les avoir rangées dans un ordre très méthodique et très chimique. Il est d'ailleurs difficile de réunir à plus de faits une érudition plus sûre et plus choisie." The elder Saussure was not behind hand in his praises. Under date of May 1778 he writes to him thus: "J'ai reçu avec plaisir et empressement la précieuse marque de vôtre souvenir dont vous m'avez honoré en m'envoyant les deux derniers volumes de vôtre ouvrage. Je n'ai pu encore que le parcourir; car il faut du tems pour le lire comme il doit être lu: mais j'en ai vu assez pour être persuadé que c'est l'ouvrage le plus complet et le mieux ordonné qui existe dans ce genre. J'y ai trouvé une infinité de faits aussi intéressans que nouveaux—de grandes et belles vuës—et une marche claire, simple, uniforme, lumineuse; comme il la faudrait dans tous les ouvrages vraiement scientifiques.'

prise called forth the thanks of the then Minister of Finances, the celebrated Necker, who in a letter on that subject conveyed to him "his Majesty's satisfaction at the new proof of his (Morveau's) love for the public welfare, and of his attachment to his Majesty's service."*

Such were indeed the claims of Guyton to the approbation of government, whose interests he studied to maintain on every occasion; but in an independent and dignified manner. For let us turn to another of his productions which appeared about the same time,† and we shall again find the faithful servant of the crown, the firm patriot, the good citizen, and the zealous philanthrophist, in him whom we so recently admired as the promoter of science and the arts—of both of which he had ever been one of the firmest supporters.

The republic of letters had in that year to mourn the loss of two men equally celebrated, Rousseau and Voltaire. Burial service had been refused in Paris to the remains of the latter; and the unprejudiced as well as the most honest exclaimed against the proceedings. Guyton, in the discourse we have just alluded to, thought it necessary to make an allusion to that event, and to express his indignation, that in a country like France, men such as Voltaire, whose rights to national gratitude and posthumous fame were countless, should be persecuted even beyond the grave. Although this candid and open avowal of his sentiments exposed for a moment the Attorney General to the attacks and libels of bigots, yet the approbation of the good and the just was with him; and what other is worth counting?

Such are the seducing attractions of chemical science, that when once abandoned to its empire, we become thirsty of more knowledge respecting nature and its different kingdoms. Guyton, like many others, soon found himself actuated by this

* This manufactory he afterwards gave up to M. Courtois, the father of the person who has been since advantageously known for the discovery of iodine.

† Discours sur l'Amour de l'Humanité, prononcé à l'ouverture des audiences de Dijon, 1778.—See Eloges, &c. T. 3.

thirst for general knowledge. To the study of chemistry and the establishing of a laboratory, soon followed the desire of acquiring a mineralogical collection, which in its turn caused the necessity of learning the nature of its contents, by studying the science which treats of them and of their disposition on the surface of our globe. All this was soon acquired; and we should have only to appeal to his numerous friends, whether M. Morveau had not become a proficient in those new branches of scientific learning, had we not his numerous writings to refer to, for the proofs of our assertion, founded besides, on a personal knowledge of the fact. In 1777, he was charged to examine the quarries of regular schistus and the coal mines of Burgundy, for which purpose he performed a mineralogical tour through that province. In the Memoirs of the Dijon Academy for 1779, we find another instance of the useful results of Guyton's new scientific pursuits, in a memoir, giving an account of a rich lead mine discovered by him, and to work which, for want of other combustibles, he sought for beds of coal in the neighbourhood, though unsuccessfully. A few years later, when Bergman had so well described the properties of the heavy spar and the earth obtained from it, Guyton, greatly assisted by his geological knowledge, searched for it in Burgundy, and found it in considerable quantity at Thôte, so as to be enabled to give to the Dijon Academy an accurate description of that mineral, and of the earth which enters into its composition, and which he afterwards called *barote* or *barytes*.* It ought also to be remarked, that although the method of separating the basis from its acid, in this case, had already been published by Bergman, in the Transactions of Upsal, Guyton proposed a different process, consisting in the decomposition of the sulphate by heat and charcoal, the consequent formation of a sulphuret, which he had occasion to observe very distinctly† in the course of the operation, and the formation of a salt (decompo-

* See Morveau's Mém. de l'Academie de Dijon, tom. iii. p. 160.

† See his Memoir in the above Transactions.

sable by alcalies), by means of muriatic acid. It was about this time too that he found the white emerald of Burgundy.

Thus ends the first period of the life we are writing—a period which would have alone sufficed to secure to our philosopher a lasting reputation. But Guyton was born to still greater deeds, and was destined to take a leading part in two of the most extraordinary revolutions that history records, of which the one entirely changed the system of chemical knowledge, and gave a fresh and a better directed impulse to science in general; while the other, with results more doubtful, completely altered the political aspect of Europe. Into this twofold career, therefore, do we now follow Guyton de Morveau, than whom no man deserves better the admiration of an impartial posterity.

To the connections which M. Guyton formed about this time* with some of the well known characters of the metropolis, must indeed be ascribed the change which insensibly took place in his subsequent calling. Known advantageously by some of them for his writings and his researches, he was requested by Pankouke, who meditated the great project of the *Encyclopedie Methodique*, to undertake the new edition of all the chemical articles in that great dictionary, and supported his demand with a letter from Buffon, whose request Guyton could not refuse, though he had long hesitated in accepting the office. The engagement was signed between them in September 1780;† and although the first part of that work did not appear till six years afterwards, still the study and the researches, which the execution of his engagement demanded, furnished him with immediate and very considerable occupations. Besides, the delay will be easily accounted for, when

* 1779-80.

† In a letter from the Duke de la Rochefoucault, a nobleman highly distinguished for his talents and his love of science, we find the following passage on the subject of this engagement: "J'ai vu avec plaisir que vous vous étiez chargé du dictionnaire de Chimie dans la nouvelle Encyclopedie; nous voilà surs qu'il sera bon et que nous serons au courant des connaissances."

it is considered, that every article demanding elucidation became the subject of particular experiments, and thus, as he himself often wrote to the publisher "le travail du laboratoire retardoit celui de la plume." How could, indeed, a work of real merit be produced otherwise, since every chemical article of the old Encyclopædia demanded to be newly modelled or differently composed?

A new doctrine, shaking to its very foundation the theory of Stahl, had been by this time publicly avowed by Lavoisier, then justly considered as the most eminent of the French chemists. He had long expressed his doubts respecting the existence of phlogiston, and its insufficiency to explain the various chemical phenomena. Led by the researches of Bayen, and the experiments of Jean Rey, he had been induced to consider the atmosphereric air as materially contributing to the phenomenon of combustion; and the experiments he made to ascertain the reality of his conjectures, proved that a certain portion of the atmospheric air disappeared during the combustion of bodies, and particularly of the metals. When this fact was announced to the Royal Academy of Sciences, a division ensued amongst the several chemists of Europe, some of whom undertook to ridicule it, and to defend the Stahlian principles; while others, on the contrary, without any hesitation, embraced the new doctrine, of which the fact advanced by Lavoisier was the principal foundation.* Macquer, who was a staunch advocate for the old

* Our readers will not be displeased to see the original letter of the celebrated Condorcet, announcing the discovery of Lavoisier to his friend Guyton, and the opinion which that great man entertained of the phlogistic doctrine.

"M. Lavoisier nous a lu à notre rentrée un mémoire où il assigne une autre cause à l'augmentation de poids des metaux calcinés; c'est, selon lui, l'air qui s'unit au metal pendant la calcination. Pendant la reduction cet air s'en sépare, et il cesse d'être chaux. M. Lavoisier a réellement calciné et reduit, par le moyen d'un verre ardent, des métaux placés sous une cloche, et ils ont absorbé de l'air pendant la calcination; de même qu'ils en ont rendu pendant la réduction."—"M. Lavoisier parait regarder cet

theory, and who had heard with perfect coolness, of the rude attack made by Lavoisier against it, wrote to his friend and correspondent, Guyton, in the following manner.

" M. Lavoisier, who during a long while kept me in all the agonies of fear, by occasionally mentioning that he had a great discovery *in petto*, which would completely overturn our poor old chemistry, has just read his memoir on this subject at the Academy, and I own, I feel much relieved. He says, there is no igneous principle disengaged from the combustible during combustion, but that the principle causing the combustion, is given up by the air to the burning body, and that there remains from this decomposition of the air its base only after the operation, which basis however, he does not profess to know. See whether I had the least reason to be afraid of him !"

Guyton indeed was not to be so easily seduced, and the moment of his conversion to the pneumatic doctrine was not come, when he undertook to write the first articles of the Encyclopædia. In him conviction could not be the effect of a great name, and a bold assertion, but of appropriate experiments and observations; and we shall see, in fact, that when these became numerous, evident, and convincing, he hastened to adopt a doctrine to which he could no longer remain indifferent.

But about this period, chemistry derived essential aid from

---

air comme faisant toute la différence qu'il- y- a entre une chaux métallique et un metal; et ne pas regarder la présence du phlogistique comme nécessaire à l'état métallique. Cette assertion me parait avoir besoin d'être prouvée par des expériences bien précises; car s'il y a quelque chose de demontré en chimie il semble que ce doit être la théorie du phlogistique."—" Je voudrais bien que vous examinassiez cette explication de l'augmentation de poids par la combination de la terre métallique avec l'air. *Vos expériences sur cette augmentation* sont si bien faites, si concluantes sur l'existence de ce phénomène, que personne ne saura mieux dissiper les nuages qui peuvent rester sur la cause.

Recevez mes remercimens et comptez sur le respectueux attachement que je vous ai voué pour la vie."

LE MARQUIS DE CONDORCET.

Guyton himself. The nomenclature of that science was obscure and barbarous, and he soon perceived that he should in vain endeavour at perspicuity, while the language remained thus absurd and inefficient. With Guyton this consideration alone would have checked the ardour of his pursuit, had not his own genius suggested the idea of reforming a nomenclature, till then, the opprobrium of chemistry. To this, therefore, he directed his attention, and in 1782,* was published his first essay on a new chemical nomenclature, forming the basis of all those subsequent changes from which we have derived so substantial benefit, and by the assistance of which, chemistry has grown from a pigmy to a colossus. No sooner, however, did this project reach the capital, than several of the members of the Royal Academy of Sciences, of which he was a corresponding member, inconsiderately undertook to oppose it, and the zealous proposer, as he himself used to say, was *accablé d'objections* in every point of his enterprize. Macquer himself, who on first learning his friend's project, had written to him "that finding it excellent, he had determined to adopt it," did not, in the present instance, dare to defend him against the multiplied attacks of such numerous and powerful opponents. Undismayed, however, and full of zeal, Guyton, with a view to obviate every difficulty, and to answer in person, the objections that might be made, went to Paris, and presented himself before the Academy, where he not only succeeded in shewing the necessity of the reform, but ultimately induced the most eminent chemists of the capital, such as Lavoisier, Berthollet, and Fourcroy, to join him in rendering that reform more complete and successful. It is, however, curious to observe, that while Guyton had thus to struggle at home against obstacles thrown in his way, by persons who till then had done little for the science, the most celebrated men of Europe, to whom he had communicated his plan, hastened to signify to him their entire approbation of it, and their gratitude for the arduous task he had undertaken. This we collect from the letters of Bergmann, Fontana, Kirwan,

* See Journal de Physique, May, 1782.

Landriani, Leonhardi, Crell, Morozzo, and others; but we must more particularly notice the ever memorable expression of the former. "Ne faites grace," says the illustrious professor of Upsal, "*à aucune dénomination impropre: ceux qui savent déjà entendront toujours; ceux qui ne savent pas encore entendront plutôt.*" An assertion replete with truth and energy.

No science, indeed, requires more precision in its various denominations than chemistry; and if any thing had yet been wanted, fully to persuade us of the necessity of reforming those that existed at the epoch in which Guyton began his chemical studies, we need only consider the false analogies to which those denominations often gave rise, the continued errors committed when speaking or writing on that science, and the confusion which ensued, to be satisfied, that in merely conceiving the first idea of that reform, which, by the assistance of others, he was afterwards enabled to complete, Guyton rendered one of the most important services to the science. For it would be folly to deny, that the immense progress since made in chemistry—the multiplied discoveries—the luminous mode in which that science is now taught and studied, and its rapid extension, are owing to the zealous exertions of Guyton, as displayed in his plan of a methodical chemical nomenclature, read at the Academy of Sciences of Paris, in 1787.* Another circumstance deserving attention is, that from the repeated conferences held with Lavoisier, Berthollet, and Fourcroy, for the purpose of receiving their observations, and corrections of his original proposition, the science derived great advantages: for while the latter were adopting the ideas of the former, Guyton became convinced of the truth of Lavoisier's new doctrine, and hastened to abjure the phlogistic theory, and to embrace the more luminous tenets of his illustrious countryman.

But in the interval that elapsed from the time when the new nomenclature was proposed, till its final adoption, Guyton had by his repeated exertions and laborious application to study

* See Mémoires de l'Academie des Sciences, 1787.

acquired fresh claims to the admiration of his contemporaries. Closely connected, by bonds of friendship and similarity of pursuits with Bergman, the chemist of Dijon thought he could not better prove the admiration he felt for his talents, than by translating his celebrated *Opuscula Chemica* into French.* Of the importance of this undertaking no one was more aware than Guyton himself;† and it was also felt by many of his own countrymen, who well knew the difficulties which the original presented to the generality of the readers.‡ The numerous notes which he also added, increased the value of this excellent work of the Swedish professor. While Guyton was thus engaged, a society of friends, equally zealous with himself for the

* Opuscules chimiques et physiques de M. Bergman, traduits par M. de Morveau, avez des Notes, 2. vol. Dijon, 1780.

† See his preface to the above translation, pa. 1.

‡ We shall here quote an extract of a letter from the Duke de la Rochefoucault, written to Morveau on the subject of the translation. "La traduction que vous allez nous donner, Monsieur, des Œuvres de M. Bergman sera un vrai présent pour le public, parceque le Latin de cet Auteur est difficile et rebute plusieurs lecteurs; d'ailleurs vos observations èclairciront les choses obscures et ajouteront un degré de certitude de plus à des assertions qui paraissent quelquefois hazardées. Mons. Bergman est le chimiste le plus illustre qui existe actuellement, et il n'est pas assez connu dans ce pays-ci." Mars, 1780.

"Je viens de recevoir le second volume des Œuvres de Bergman. Cette traduction est un bien veritable service que vous rendez à la Chimie, dont il a si fort étendue la sphere." Nous avons eu aussi un Mèmoire de M. Pelletier sur l'acide marin déphlogistqué (chlorine) et cette matière forme une discussion entre Mons. Berthollet et lui. Nous verrons dans votre dictionnaire le développement de vos idées sur le phlogistique dont vòus êtes un des plus illustres defenseurs. Il a aussi d'illustres adversaires, mais ce qu'il y a de bon dans cette discussion, c'est qu'elle donne lieu à beaucoup d'expériences, et que la science y'gâgne." Mai, 1785, Paris.

But let us see what Bergman himself thought of this translation. One of his letters to Morveau dated from Upsal, Oc. 1781, begins in this manner, "Enfin le 20 Septembre est arrivé le paquet tant desiré, contenant deux exemplaires de la traduction du 1er. vol. de mes Opuscules; et quoique encore tout faible d'une maladie qui

propagation of chemical knowledge, undertook to translate, under his directions, every interesting foreign memoir. Thus in the course of seven years these indefatigable writers produced more than forty translations, inserted in the scientific journals of that time. Amongst these are Scheele's chemical memoirs and letters, translated by Madame Picardet, who will again appear before us in the following pages, and who also in 1790 published, amongst several other memoirs, a translation of the external characters of fossils, by Werner. It was on account of this assiduity of the savants of Dijon, in making known whatever was published in foreign countries, that the wits of Paris, on seeing a translation of a scientific work, used to say, "cela vient du *bureau de Traduction* de Dijon;" but the malicious interpretation that might be given to this meagre *bon mot*, was perfectly counteracted by what Lavoisier said to Guyton himself in 1751, while coming out of one of the meetings of the Academy of Sciences: "c'est à vos compatriotes de Dijon que nous devons d'être au courant de ce qui se publie de plus intéressant pour les sciences chez l'étranger."

We shall not undertake to mention every memoir published by Guyton during the six years which elapsed from his undertaking the chemical part of the Encyclopædia, to the publication of the first volume of that excellent work. We must refer to the Memoirs of the academy of Dijon, which he furnished with upwards of twenty papers; and to the *Journal de Physique*, in which he inserted several memoirs on various and important subjects.

In 1783, in consequence of the favourable report made by Macquer to government, Guyton obtained permission to establish a manufactory of soda;* and in the same year he published

m'avoit presque fait périr, je n'ai pu pourtant m'empêcher de feuilleter dans cette belle édition. Partout, où j'ai lu, j'ai reconnu mes pensées fort bien exprimées. Vous vous êtes encore donné la peine d'éclaircir le texte par des notes qui décèlent non moins d'amour pour la verité, que de complaisance pour l'Auteur."

* The most important process consisted in mixing lime with muriate of soda, which he exposed on extensiv surfaces to the

his Collections of Pleadings at the Bar,* among which we find his "Discours sur la Bonhomie" delivered at the opening of the sessions of Dijon, and with which he took leave of his fellow magistrates, surrendering the insignia of office, having determined to quit juridical avocations.

On the 25th of April, 1784, Guyton, accompanied by the President Virly, ascended from Dijon in a baloon, which he had himself constructed, and repeated the experiment on the 12th of June following, with a view of ascertaining the possibility of directing those aerostatic machines, by an apparatus of his own contrivance. He had been led to this, by the interesting and important experiments of MM. Charles and Robert, the former of whom made the first application of the hydrogene gas to the purposes of aerostation. The description of the balloon, having a capacity of 10,498,074 cubic feet, and apparatus, together with an account of the voyage on both occasions, will be read with peculiar interest.† While employed in preparing for his aerial excursions, he was visited by the unfortunate Rozier, who had then scarcely recovered from an accident he had met with in a recent experiment with a Montgolfier, at Lyons, and to a repetition of which he afterwards fell a lamented victim.

The effect produced by this bold undertaking by two of the most distinguished characters of the town, was beyond description. This experiment was then quite new, and looked upon with a kind of reverential awe, that tended to augment considerably the admiration which the Bourguignons already felt for their illustrious countryman.‡ Though M. Morveau failed in

---

contact of air, thus effecting the decomposition of the salt and the formation of the carbonate by efflorescence. See Annales de Chimie, tom 19.

* Playdoyers sur plusieurs Questions importantes de Droit, &c. Dijon. Mailles, 1785, 1 vol. 4to.

† See Description de l'Arcostat de l'Academie de Dijon par MM. Morveau, Chaussier, Bertrand, Dijon, 1784.

‡ We think it not amiss to insert here a little poetical trifle composed in the dialect of the county, to celebrate M. Morveau's ascent. It is remarkable for the neatness and the facility of its versification, and will have the double merit of shewing that the

establishing the mode of directing those aerial vessels; his method was ingenious, and one of the best which had been, till then

---

language of poetry belongs exclusively to no particular station in life; since a hair dresser could thus converse with the Muses.

CHANSON BOURGUIGNONNE.

Sur le Ballon lancé à Dijon le 25 *Avril* 1784, *sur l'Air:* J'étois gissant dans cette place; *récitatif de Colas, dans l'Opéra des deux Chasseurs et la Laitière.*

J'éto lai plantai su lai tarre,
J'antandi le cainon ronflai,
Quan béto ai ce bru de guarre
On vi ein baitéa s'anvôlai,
Ene bôle desu lo téte;
Ca le diale qu'éto dedan:
Ai les ampoto po le van,
Sans que ran du tô les airéte. (*bis.*)

Pandan quai fesein lo viaige,
Le monde aivo le cô tandu;
Montan pu hau que lé nuaige,
On se diso: ai son padu;
Chaicun grullo dans sai gargaisse,
On éto lai ben éboni:
Po mo j'an éto tô transi,
Fesan ene peute grimaice. (*bis.*)

Lé jan qu'étein lai dan lo plaice,
Bâillien tô quemam dé Corbéa,
Se disein: jaimoi de lai raice,
Lé baitéa n'on soti de l'éa;
Je n'on pu besoin de riveire,
Ni de l'Ouche ni de Suzon;
Béto parché dans lo Ballon,
Du Sôlô parron lai lemeire, (*bis.*)

Ma tô le pu béa de lai féte,
Ca quant ai s'an son revenu.
Tô le monde an tono lai téte,
Corein lé gambi, lé bôssu:
Tôte lé Daime de lai Ville
Etein plantai su le chemin:
Tô lé cairôsse alein gran train,
Se seuvan tretô ai lai fille. (*bis.*)

imagined ;* and our countryman Kirwan, who, like the other correspondents of M. Guyton, begged him to spare a life, already so precious to science, and not again to risk it in such frail machines; stated to him that he thought his mode of directing the balloon extremely plausible.

When Prince Henry of Prussia passed through Dijon, he begged Guyton to tell him frankly what had been his sensations during the ascent. " We felt as tranquil, answered the philosopher, as when sitting in our cabinets." The prince thought he knew mankind too well to believe this assertion, and quitted the room with some tokens of displeasure at what he considered as ostentatious fortitude: but he was soon reconciled, when Guyton explained the difference between the sensations experienced in the case in question, which were the effect of personal resolution, and of the confidence placed in the means of safety; and those he felt on looking down from a high steeple, when his head invariably became giddy, and he trembled for his existence.

Le cortaige n'éto pa mince,
Pu de cinquante Cavalié ;
Vos eussien di : veci le Prince,
Tenan dans sai main le laurié.
Vive *Morveau*, crio le monde,
Ai peu vive l'Aibé *Bertran*,
Tô deu coraigeou ai saivan :
Cai se repeto ai lai ronde. (*bis.*)

Par M. Gallbton, Maître Perruquier.

* We must not suppose that the idea of the possibility of giving a proper direction to balloons, could enter the head of persons only who were strangers to the principles of mechanics. We have had occasion to peruse an original autographic letter, never before published, which one of the most distinguished engineers of France, and since better known for his political and military career, wrote to the Academy of Sciences of Paris, in 1784, offering to demonstrate the possibility of giving the direction in question, had they thought proper to hear his explanation, founded on the soundest principles of mechanics. The letter bore no name; but is known to have been written by Carnot when quite young. It was found amongst the papers of the late eminent engineer and geometrician General Meusnier, who had been directed by the Academy to exmine the various aerostatic projects then proposed.

It was about this time that the late much lamented Mr. Tennant visited Dijon, and formed an acquaintance with Guyton,* in whose laboratory he repeated several interesting experiments, such as those tending to prove the existence of phosphoric acid in some lead ores, and the rapid spontaneous crystallisation of those phosphates on cooling, whether natural, or artificial; as well as some other experiments on the combustion of diamond; on which M. Morveau made afterwards so many important observations.†

In 1786, Lavoisier, on transmitting to him his nomination as a Member of the Royal Academy of Medicine, observed that "La Societé Royale de Médicine en vous appellant au nombre de ses membres apprendra au public, qu'elle sait apprécier les connaissances relatives à la médicine, quoi qu'elles soient hors des facultés et des écoles." Dr. Maret, the secretary of the Dijon Academy, whose son played so conspicuous a part in the revolution, and under the late government of France, had just fallen a victim to an epidemic disease, whose destructive effects he had endeavoured to arrest; when the Academy devolved upon his inconsolable friend the office of perpetual Secretary, and Chancellor of that Institution. The loss of that eminent practitioner was felt by all who knew him; and a just tribute o praise paid to his memory by Guyton, shewed the warm attachment that had existed between them.

The important researches of MM. Monge, Vandermonde, and Berthollet, on steel, had just been published,‡ and engaged the attention of every chemist; but how greatly surprised must Morveau have been to find, from a perusal of them, that he had established the same principles in his article on *steel,* printed

* Mr. Tennant had been introduced to the Chemist of Dijon, by Mr. Kirwan, with a letter beginning thus: "Vous recevrez celle-ci des mains de M. Tennant jeune gentilhomme Membre de nôtre Société, et de mes amis particuliers, qui possède des grandes connoissances chimiques pour son âge; et qui voyage pour les augmenter, et avoir l'avantage de connoître ceux qui se distinguent en les cultivant. C'est vous seul qui l'attirez à Dijon, et c'est à vous par conséquent que je dois l' addresser."

† See *Ann. de Chimie.*

‡ See Journal de Physique, Sept. 1786.

for the Encyclopædia, though not yet published! Fearful, lest he should hereafter be considered as a plagiarist, he lost no time in writing to Berthollet, that he would find in the printed sheets of the Encyclopædia, then in the hands of the publishers in Paris, under the article Steel, the same conclusions to which MM. Berthollet, Monge, and Vandermonde had been led by their experiments. This letter of *reclamation* left Dijon the 7th October, and Berthollet, with that candour, and love of truth which ever distinguishes a really great man, sent the letter for insertion in the same journal, that had but a few days before announced his own opinion and experiments.*

At length the first part of the volume of chemistry of the Encyclopædia made its appearance, and was seized upon with avidity by every one who took an interest in the progress of that science. This work is too well and too generally known to need any eulogium on our part. We do not hesitate in classing it foremost amongst the most valuable productions that have appeared within the last thirty years on the subject of chemistry; and we consider it as having stamped the name of its illustrious author with the indelible character of an eloquent and elegant writer—of an accurate experimentalist, and of a profound philopher. In this we are not singular; since every person who has had occasion to consult the work in question, must have necessarily formed the same opinion of its prominent and intrinsic merits. The article Acid, alone, is a complete history of the science. The erudition displayed in it, and the numerous and well digested facts to be found throughout—the clear exposition of the various doctrines announced and supported by the different authors who have written on chemistry—and finally, the accurate and full details of the various experiments that had been made in almost every part of Europe, down to the time of Guyton's writings, are in themselves sufficient to ensure him an everlasting fame.

All the eminent men of France, England, Germany, and Italy, for there was but one voice on this occasion, hastened to pay their just tributes of praise to the writer; and numberless are the letters which we might quote on this subject,

* See Journal de Physique, Tom. 29, p. 308.

from Lavoisier, Fourcroy, Berthollet, Bergman, Kirwan, Crell, Fontana, Morozzo, Landriani, and others, if we were not apprehensive of extending this biographical memoir to an unwarrantable length. This book, full of the most important information on some of the principal points of chemistry, was read and consulted with advantage at the time of its publication—in our own days, it is often looked into with pleasure—and it is not too much to say, that even in future ages, when chemistry shall have reached a still higher degree of perfection, this same work will be referred to with considerable satisfaction.*

It was Guyton's good fortune to have a man as eminent as himself for a successor in this undertaking. Fourcroy, at the express invitation of Guyton, was applied to, by the publisher, to continue the chemical part of the Encyclopædia; and having accepted the proposition, on condition that Guyton should communicate to him his vocabulary—notes—articles already begun—extracts—translations, and drawings; the latter, with that liberality which ever distinguished him, lost not a moment in sending him every thing he had asked for, together with the entire article on Metallurgy by Duhamel, and the plates relating to it.

In September 1787, our Professor was pleasingly surprised by the honor of a visit from Lavoisier, Berthollet, and Fourcroy, accompanied by their respective ladies, and MM. Monge and Vandermonde. By a very lucky coincidence, Dr. Beddoes of

---

* Amongst the most flattering testimonials of the masterly manner in which the various chemical articles of the Encyclopædia were executed, we must not omit to mention the one found in the elementary treatise of chemistry of Lavoisier. Speaking of the word *affinity*, in his preface, this celebrated chemist observes, that most likely his readers would find him, on that subject, too short and concise; but, said he, " peut être un sentiment d'amour propre a-t'il, sans que je m'en rendisse compte à moi-même, donné du poids aux réflexions qui m'ont rendu concis. M. de Morveau est au moment de publier l'article *Affinité* de l'Encyclopedié méthodique, et j'avois bien des motifs pour redouter de travailler en concurrence avec lui." Nothing can be more delicate or flattering.

Bristol, who was travelling through France at the time, happened to pass through Dijon, and joined this party, who had assembled to repeat and discuss several experiments explanatory of the new doctrine. Guyton's assumption of it made a strong impression on every person who knew how strongly he had supported the Stahlian views. The unfortunate La Peyrouse, amongst others, who then resided at Thoulouse, and was one of the most distinguished members of that Academy, and who was in the habit of corresponding with Guyton, could not help referring to this change of chemical tenets in one of his letters, written but a short time before he embarked for the voyage which ended so fatally for him and for science. "Voilà donc," says La Peyrouse, "le pauvre phlogistique totalement oublié! Vous étiez son plus terrible défenseur et vous l'avez proscrit comme indigne de vos efforts. On nous assure même que vous faites réimprimer la partie de l'Encyclopédie chimique que vous aviez déjà publiée, afin de la mettre à l'unisson de la nouvelle doctrine. Ceux qui aiment veritablement la science, ne peuvent que se rejouir de voir les progrès que vous vous lui faites faire. Heureux, Monsieur, de n'être plus distrait par mille occupations étrangères."

An attempt was made in 1789 by some of Guyton's friends in Paris to overcome the many difficulties, prejudices, and intrigues, which had hitherto impeded his reception at the Royal Academy of Sciences. Berthollet, anxious to see him established in the capital, and named to a vacancy which had just occurred at the Academy, earnestly recommended his paying an immediate visit to the metropolis. "Il est important que vous arriviez le plutôt que vous pourrez, pour qu'on soit persuadé de vôtre projet, ou plutôt pour que vous paraissiez avoir déjà pris domicile. On rencontrera des obstacles; cependant nous avons tout à espérer si vous arrivez."

Intrigue however, as was found, prevailed, and another was named to the vacant *fauteuil*. The same eminent chemist, who had so anxiously exerted himself in favour of Guyton, again wrote to him, on this occasion, in the language of truth and friendship thus: "Vous avez été instruit, sans doute, par le President de Virly de nos espérances et de la manière hon-

teuse dont elles ont été trompées; mais vous êtes trop au-dessus des titres littéraires pour avoir quelques regrets. Pour moi je regrette principalement l'espérance de vous voir partager vos soins et vôtre séjour entre Paris et Dijon."

It was about this time that Guyton received a visit from Sir Charles Blagden, announcing, by a letter from Sir Joseph Banks, his election as Member of the Royal Society.*

Anarchy had now began to rear its head, and Discord stalked abroad throughout the country. There was a rottenness in the state, the seeds of which had been laid by the faults of successive governments, and which the undecided measures of irresolute financiers were by no means calculated to remedy. The impracticable idea of the austere and unaccommodating man at the head of the financial affairs to maintain the war which France had waged against this country, by means of loans without any additional taxes, could spring only from one who, like him, an adventurer, had all his life been accustomed to the details of a counting house, rather than to the vast measures which France demanded, and which she was not likely to see adopted by a minister who was alike a stranger to her habits and her national prejudices. The financial embarrassments became more and more alarming; public credit as well as public resources were exhausted; engagements entered into by government were not fulfilled, and payment stopt at the public treasury. The first meeting of the assembly of the *Notables*, which was to have healed the wounds of the state, had taken place two years before the epoch we are now recording; and had ended in total disappointment. Indeed it was not to be expected, that a plan, the principal object of which was to lay heavy taxes on two classes of people hitherto entirely exempt, would meet with their approbation, much less with their support. The clergy opposed strenuously every endeavour to encroach upon their privileges; and the nobility resisted with indignation and force,

* M. Morveau was besides member of almost every scientific society of celebrity in Europe; as can be learned from the various and numerous diplomas I have found amongst his papers.

the attempts of government to induce them to become instrumental in saving the state, and in relieving the sufferings of the people; while the latter, equally disgusted with the pride and profligacy of the one, and the insolence and superstition of the other, could no longer endure the state of misery and oppression into which they had been plunged. The popular mind was now in such a state of discontent and irritation, that the most trivial circumstance would have sufficed to make it break forth in violent outrages against their governors. Unhappily this became soon after the case, when on the Notables being dismissed, royal edicts were issued for raising money throughout the country. To these the Parliament of Paris objected in the most peremptory language; and neither a *lit de justice*, nor the banishment of each individual member from the capital, could counteract its effect. Disaffection spread itself over the kingdom, and the presence even of large bodies of troops was insufficient to check its progress.

The States General were now had recourse to, as the last measure of safety. The king endeavoured to conciliate the public good will in its opening speech; and but for the injudicious interference of the minister, who had by this time been recalled, might have succeeded in palliating the increasing evils, which had struck the nation with a delirious stupor. As things were, the spirit of contention began to seize the deputies of the three states at the very outset of their operations; and the National Assembly was established by the bold measures of a single individual. The kingdom was now divided into departments; and, in 1790, Guyton received a letter from Count St. Priest, naming him one of a commission, appointed by the Assembly, for the formation of the department of the Côte d'Or. Till then, and from the time of his resigning the chief magistrature at the parliament of Burgundy, he had abstained from all interference in political matters; and although the unhappy turn which affairs had then taken, formed often the subject of lamentation between himself and his numerous correspondents in the capital, still he was far from wishing to take any decided part in the

contest. While thus engaged for the public service, he received a fresh mark of the high consideration in which his talents and knowledge were held by the most eminent among the learned of his nation, and on the 25th of August 1791, obtained, from the Academy of Sciences, the great prize, which was annually decreed to the most useful work, for the first volume of the Dictionary of Chemistry in the Encyclopædia. His triumph on this occasion was the more gratifying to him and his friends, that amongst his competitors was the celebrated professor Scarpa, who had recently published a highly esteemed work on anatomy. Lavoisier, who had been greatly instrumental in thus determining the favourable decision of the Academy, remitted, in his quality of treasurer to the Society, the prize to his friend, accompanied by an appropriate congratulation; and the latter, aware of the pressing wants of the state, seized the opportunity of contributing his mite towards their relief, by making a patriotic offering of the whole amount of that prize he had so deservedly acquired.*

The new constitution presented by the first National or Constitutional Assembly demanding a new election of the legislative power, Guyton was, on the 7th of September, nominated to the legislature, by the electoral college of his department. A few months before, his name had been included in the list of the members proposed by the Assembly for the election of a governor to the heir apparent; and the dignity of solicitor-general of the department, to which he had recently been raised, not permitting him to continue the chemical lectures at Dijon, of which he had already given fifteen courses gratuitously, he resigned his chair in favour of Dr. Chaussier, one of the present most distinguished professors at the Faculty of Medicine; and bidding adieu to his friends and the place of his early exploits, proceeded to Paris.†

* The value of the prize was 2000 francs.

† One of his dearest and most intimate friends composed the following lines, on this occasion, to be inscribed on the bust of Morveau, now deputy to the National Assembly, in which his various avocations are traced in the warm language of friendship.

But though thus immersed in public and political transactions, Guyton did not lose sight of his favourite object—the progress of science; and even in the exercise of his new duties found an opportunity of rendering it a valuable service. A rich and extensive collection of objects of natural history, books, paintings, and scientific apparatus, belonging to a gentleman who had emigrated, having been condemned to the hammer for the profit of the public treasury, by which the collection would have been dispersed without producing any adequate and advantageous result; Guyton rose in the Assembly, and obtained an exception in favour of this collection, from the effects of the general law published against the property of emigrants. Indeed his sentiments on this subject were soon after completely gratified, and the cause of learning secured from further encroachments, by his being appointed one of the commission for the preservation of Gallic Monuments and every object of public instruction. This was another triumph obtained by eloquence in favour of science.

The two parties in France now came to that close contest which was to have ended in the destruction of the weakest. The ever memorable 16th of January 1793 came, and Guyton following the example of many more, who from the integrity and respectability of their character, might be supposed to have exerted a considerable influence on his decision, voted with the majority on that day, so fatal for the cause of royalty in France. In the same year he resigned, in favour of the Republic, his pension of two thousand francs, and the arrears of that pension.

In the following year, being in the Low Countries, Guyton received from government different commissions, to act with

---

De Thémis, de ses loix on l'a vu le soutien,
Et ce titre sans doute suffi à sa mémoire:
Le titre de Savant à ses yeux ne fut rien;
Ne voulant arriver au Temple de la Gloire,
Qu'en se parant encore du nom de Citoyen.

PIC.

the armies of the French Republic, and displayed, on many occasions, a personal bravery that called for the praises of the general officers. Charged with the direction of a great aerostatic machine for warlike purposes, he superintended the employment of that, in which the chief of the staff of General Jourdan and himself ascended during the battle of Fleurus, and which so materially influenced the success of the French arms on that day.* On his return from his various missions, he received from the three committees of the executive government a joint invitation to co-operate with several learned men in the instruction of the central schools, and was named Professor of Chemistry at the *Ecole Centrale des travaux publics*, since better known under the name of Polytechnic School, in which he greatly contributed to the formation of those numerous and eminent men, whom that celebrated and highly useful establishment has produced.

In 1795, Guyton was re-elected member of the Council of Five Hundred, by the electoral assemblies of Sarthe and Ile et Vilaine: when the executive government having decreed the formation of the National Institute, he received a letter from the Minister of the Interior, announcing that he had been named one of the forty-eight members chosen by government to form the nucleus of that scientific body. His nomination gave infinite satisfaction to the greatest part of the old members, who knowing how well and how long he had deserved the honour now spontaneously conferred upon him by government, rejoiced to see him amongst them in spite of of intrigue and malicious interference.

Although Guyton had, at the commencement of that

---

* It is easy to conceive that by means of a balloon managed in the same way as the one employed at the battle of Fleurus, following the movements of both armies, and facilitating the view of every evolution made by the enemy, on a surface even of four or five leagues, a general might ensure the success of his operations, while he eluded all the *ruses* and deceiving manœuvres of his opponent.

Revolution, which so entirely changed the political state of France, taken an active part in the various arrangements rendered necessary by that event; as well as in all the civil and military operations; still it was evident, that to a man like him, who was a total stranger to political intrigue, and incapable of becoming a party in the cabals of public men, the new life he had been induced to lead, from the circumstances of the times, could not become him longer than his country had need for his talents. Hence we see him resigning all public situations in 1797, and once more attaching himself exclusively to science and to the establishments for public instruction. The absence of Monge, who was then in Egypt, requiring the appointment of a provisional director of the Polytechnic School, Guyton was appointed to that responsible situation, by the Directory, in 1798, and continued to exercise its duties during nineteen months, to the complete satisfaction of every person connected with that establishment. Nor did he, by the exercise of so much additional duty, require any additional recompense from his countrymen. On the contrary, with a delicacy which seldom meets with example, he declined receiving the salary of 2000 francs attached to the situation, and which he thought belonged to the proper director, although absent from his duties.

At the end of 1799, Buonaparte, as First Consul, appointed Guyton one of the *Administrateurs generals* of the Mint, and the year following, director of the Ecole Polytechnique.

The Legion of Honour had been but recently instituted for the reward of eminent services rendered to the State, when Guyton received the cross of that Order from the hands of the First Consul, in the Church of the Invalids. His promotion to an officer of that same order, took place in 1805, two years only after obtaining his first decoration. This fresh mark of the approbation of government, was given in consideration of the great advantages which had accrued to suffering humanity, from his mineral acid fumigations. We learn this from a letter which the Great Chancellor of that Order, Count Lacépede, a man equally attached to him by the

bonds of friendship, and a similarity of taste for scientific pursuits, wrote to him on that occasion.*

---

* A Monsieur Guyton de Morveau, Officier de la Légion d'Honneur, Membre de l'Institut National.

Paris, 9 *Ventose an* 13, (28 *Février*, 1809.)

Vous ne vous êtes pas contenté, Monsieur et cher confrère, de hâter les progrès de la Chimie, par vos leçons et par vos écrits, vous avez voulu, dès votre entrée dans la carrière des sciences, que vos vastes connaissances servissent à diminuer les maux de l'espèce humaine.

L'Europe et l'Amérique savent que dès 1773, vous aviez découvert que l'emploi des fumigations d'acide muriatique pouvait arrêter les effets de fièvres contagieuses et funestes.

Vous l'aviez prouvé dans votre patrie, par une expérience remarquable, plusieurs années avant qu'un procédé analogue ne fut employé chez une nation voisine, et récompensé avec solemnité par ses représentants.

L'Academie des Sciences et la Société de Médicine avaient applaudi à vos succès.

De nombreuses applications de la découverte qui vous honore et que vous aviez perfectionnée, viennent de montre en Espagne et dans les Antilles, quels heureux résultats on doit en attendre, pour préserver le monde de ce mal terrible, qui, connu sous le nom de *fièvre jaune* et rival de la peste, a menacé de couvrir le globe de cadavres.

Vous avez complété votre ouvrage, en imaginant un appareil propre à rendre plus facile et plus utile, le procédé que vous aviez inventé.

La science avait reconnu votre bienfait; la reconnaissance publique l'a proclamé; l'humanité souffrante vous a béni; aujourd'hui, la gloire vous couronne.

L'Empereur, qui ne cesse de veiller aux destinées des peuples, a vû vos travaux, votre persévérance, et vos succès. Il vous décerne une palme. Il veut qu'une marque particulière de sa bienveillance atteste à tous les yeux et le service et la récompense. Il m'ordonne de vous adresser un brevet d'officier de la Légion d'Honneur.

Il est bien doux pour le plus ancien de vos confrères, d'être chargé par sa Majesté Impériale, de vous annoncer ce témoignage de son estime.

J'ai l'honneur de vous saluer.

(*Signé*) Lacepede.

Nor did the government stop here in its public demonstrations of that consideration and esteem which Guyton so fully deserved, for in 1811, he was created Baron of the Empire, a title recognised by the succeeding administration.

Sixteen years of uninterrupted labours at the *Ecole Polytechnique*, since 1798, (for notwithstanding all his other occupations and responsible situations, he had not for a single moment ceased from his duties as professor of chemistry at that school) seemed to entitle him to an honourable retreat. This he obtained on application to the proper authorities, and withdrew from public into the retired station of private life, crowned with years and reputation, and followed with the blessings of the numerous pupils whom he had brought up in the career of science :—but alas ! for them, and his numerous friends, his time of repose in this world was to be but short: he lived but three years more to witness still greater changes in the politics of his country, than those to which he had been instrumental, and to see the complete overthrow of that system, the beginning of which had so fatally deluded the majority of the best thinking men in France with hopes of success. Guyton was seized with a total exhaustion of strength on the 21st December, 1815, and expired in the arms of his disconsolate wife and a few trusty friends, Dr. Chaussier and M. Prieur, his relation, after three days only of illness, having scarcely completed the eightieth year of his age. His remains were followed to the grave by the members of the Institute, and many other distinguished characters of the Capital, on the 3d of January, where Berthollet, one of his earliest colleagues, pronounced, according to custom, a short, but impressive funeral oration on his departed friend; when all that was mortal of this celebrated man was committed to the earth—his spirit and name winging their flight to the abode of immortality.

Mons. Guyton de Morveau was of a middle stature, and well made—with a quick penetrating eye, and a countenance full of intelligence. His health, notwithstanding the many and arduous occupations of his long and useful life, had been but seldom chequered by disease, his constitution having progressively improved with mental and corporeal exercise.

He was fond of conversation ; and though rather inclined to take the lead in it, he knew how to listen to that of others, whenever the laws of politeness, or the prospect of gaining information, demanded it. In his intercourse with society, he was cheerful, and of the most amiable disposition. The purity of his language—his uncommon store of information on almost every subject connected with sciences, the arts, and polite literature—and the agreeable manner of relating the numerous anecdotes with which he had become acquainted during a long and busy career, made his company much sought after ; while his polite address and condescension, considerably heightened the advantage of possessing him among the circles which he most usually frequented.

Attached to the accomplished widow of Mons. Picardet, an Academician of Dijon, by a similarity of taste and scientific pursuits, and by the softer feeling of a warm friendship, Mons. Morveau joined his to her destiny by the bonds of wedlock, though both already advanced in years. Madame Picardet had rendered some important services to science by her translations of foreign authors, already mentioned in the course of these memoirs. But besides these, she has furnished numerous articles to the *Journal de Physique*, translated from the Italian, the German, Swedish, and English language. Indeed the works of Bergman, Scheele, Landriani, Kirwan, Crell, and Klaproth, may be said to have been first made known to the French savants by the exertions of this lady, who has also added to French literature, a translation of some of Ossian's poems, and some fugitive pieces of poetry.

The probity of Mons. Guyton de Morveau's character had become proverbial amongst all those who knew him, and had withstood the seductions of profligate times, and the temptations of high and lucrative places. In his professions he was sincere ; and whether he be considered as a public or a private individual, his notions will be found to have ever been of the utmost purity, approaching almost to an austere rigidity.

No one ever exerted himself with greater assiduity, during a very long series of years, in public and private life, than Mons. Guyton de Morveau.—*Procureur-général* for the space

of two and twenty years at Dijon—solicitor-general of one of the French departments—member of the legislative body—of the national convention—of the council of Five Hundred—occasionally upon the committees on financial, diplomatic, and legislative subjects—commissary to the armies and to the frontiers—and, finally, director-general of the mint, he might fairly be supposed to have had no time for any other occupation. But when we reflect, that he was still better known for his services to science—that he was a public professor of chemistry at Dijon and Paris, for upwards of thirty years—that he fulfilled the duties of director-general of the Polytechnic School for a considerable space of time—and, finally, that during twenty-six years, as member of the National Institute, he furnished several important memoirs and reports to that scientific body, published in its transactions, besides many other papers printed in the *Annales de Chimie*, of which he was one of the earliest and most indefatigable editors—we cannot withold that tribute of praise and admiration which his memory now demands, and which it will call forth in all future ages.

Art. II. *An Inquiry into the Varieties of Muscular Motion, and their Connection with Peculiarity of Texture in the Moving Organ.* *By* J. R. Park, *M. B. &c.*

The various modifications of the moving power are not less numerous nor less important than those of the sentient faculty. Their number corresponds with that of the organs composing the animal frame; and their investigation is calculated to throw light on the performance of every function.

In fact, no practicalutility could result from knowing the general laws of motion as already ascertained, without a knowledge of those causes which modify their influence and vary their operation. Nor could it avail us any thing to have traced out the remarkable connection between the vital

powers and the state of circulation, if we could not also discover the circumstances on which the state of circulation depends.

To ascertain the origin of altered circulation, we require not only a knowledge of the general laws of motion, but likewise an accurate acquaintance with all its forms and varieties; and having determined the former, we are now prepared to enquire into the latter.*

In tracing out the general laws of muscular motion, the plan pursued was that, recommended by Lord Bacon, of strict induction from the phenomena, without any regard to their supposed cause. Yet these laws, when ascertained, appeared evidently to result from the nature of the physical means by which motion is effected.

The view we adopted respecting the nature of muscular contraction was that of Whytt and Bichât, in preference to the opinion entertained by Haller. We were led to the conclusion that muscular contraction results from a change of condition in the moving fibre, effected through the influence of the nerve; but that the nerve, instead of acting as an exciting cause, to call forth the exertion of a power inherent in the muscle, actually furnishes the efficient means, or direct agent, which produces the change in question.

---

* The views of Dr. Parry, of Bath, offered in his work on Pathology, recently published, nearly coincide with mine, as far as regards the influence of altered circulation; but towards determining the causes from which change of circulation proceeds, little or nothing is attempted by Dr. Parry.

The chapter on Derangement of Function, in my Inquiry into the Laws of Animal Life, and the latter part of Dr. Parry's work, will be found to contain the same principles, supported by the same arguments, and many passages expressed in nearly the same words.

This singular coincidence is not mentioned as a charge of plagiarism against Dr. Parry, but to vindicate from the suspicion of it a work printed three years prior to his, and at the same time to point out the limits of the coincidence between us; for though we agree in general principles, we differ in most of their modifications, and their causes are not investigated in the work of Dr. Parry.

This it appears to effect by imparting to the muscle some peculiar fluid or energy, which operates upon it in such a manner, as transiently to alter its state of aggregation, and throw it into contraction. Such at least was the view with which the phenomena were found best to accord.

Pursuing still the same mode of investigation, we were also led from observance of the phenomena to infer, that similar means are employed in producing voluntary and involuntary motion; which are accordingly subject to the same general laws, each having certain limits affixed to its powers; and each exhibiting stated periods of action, and subsequent periods of comparative relaxation or rest.

Consequently motion under both these forms was deemed to be essentially the same faculty; and every argument against this conclusion, resting on experimental grounds, was shewn to be fallacious, tending to confirm rather than disprove that similar means are instrumental to its production in both.

The phenomena are, however, widely diversified as they present themselves to our notice in different classes of moving fibres; and the examination of these varieties is the object which now claims our attention.

The voluntary organs are remarkable for the force, rapidity, and extent of their evolutions, for their subjection to the controul of the will, and their liability to experience the sense of fatigue.

The two latter circumstances they owe, as before explained, to the origin of their nerves, and their more intimate connection with the sensorium. The former appear to be immediately derived from their peculiar texture and organization.

They are composed of considerable masses of fibres running longitudinally, and formed into round or flattened cords, terminating at each extremity in a strong tendon which knits them to the bone; or they are disposed in broad bands, terminating in strong fibrous membranes, which answer the same purpose as the tendons. To this mode of structure and application their most striking peculiarities are to be ascribed.

The extent and rapidity of the evolutions performed by the

limbs, are chiefly owing to the mode in which their muscles are applied. The moving power is affixed so as to act upon the short arm of a lever, and thus communicates to the opposite extremity of the bone, a range of action very considerable, while the muscle exerts a degree of contraction comparatively small.

The power they are called upon to employ, in order to effect their purpose is, however, increased in proportion to the length of lever against which they act. Thus the muscles of the shoulder, in raising one pound with the arm extended, exert an effort probably capable of raising fifty pounds, if more directly applied to the object. This extraordinary power in the voluntary muscles, results in part from their superior size, or the number of fibres brought to bear upon one point, —"those muscles being comparatively stronger (as Richerand remarks) which are composed of a greater number of fibres;" —and in part it may be connected with the texture of each fibre, "those muscles (as Bichât observes) which have longer fibres being more conspicuous for rapidity and extent of contraction, and those in which they are shorter, for its force and durability."

Continuity of exertion is generally less conspicuous in the voluntary than in the automatic functions, in which some organs, as the heart, continue their efforts through life without intermission. This power varies, however, very materially in different muscles, and some of the voluntary will be found capable of an exertion, which when duly considered, will appear little less surprising than that of the heart.

As each is by nature adapted to its own mode of action, so each can maintain for the longest period that which is peculiar to it, one being calculated for promptitude and variety in its efforts, another for strength and durability.

These opposite powers are well worthy of attention, for they are retained in disease no less than in health, and give rise to the distinctive characters of those convulsive affections peculiar to each class of muscles. They will generally be found, as in the following examples, to prevail in an nverse ratio to each other, strength and continuity of con-

traction being greatest, where mobility and range of action are least.

Of the voluntary organs, those endowed with the greatest power of permanent contraction are the muscles at the back of the neck, which exert a considerable effort in supporting the head, and continue that effort for twelve or eighteen hours together without growing weary. Those also which support the lower jaw must exert a constant effort, as appears from the falling of the jaw, when these muscles are paralized, and they are likewise little subject to the sensation of fatigue. Next to the muscles that support the head and lower jaw, those of the trunk appear most capable of permanent contraction, as they only obtain relief when the body is placed in a reclining posture, whereas it often remains erect for ten or twelve hours together. The muscles of the lower extremities are less permanently contracted than those of the trunk, as they obtain rest whenever we sit down; and from long standing, the legs grow weary sooner than the trunk. The upper extremities do not seem equally adapted for a constant effort like that exerted by the lower in standing or walking, but are more apt to grow weary from a similar mode of exertion, as may be proved by holding out the arm, or turning a wheel. The muscles of the fingers appear to possess less permanency of contraction than the ball of the thumb, which gives the principal strength in closing the hand. Lastly, the muscles of the face and those of the organs of speech are least permanent in contraction, or lowest in the scale of continuity.

On the other hand, the muscles of this class are little subject to fatigue from that mode of exertion which is adapted to their nature, or from frequent and rapid change of action. For promptitude and variety of motion, the organs of speech are eminently conspicuous, as appears from the numberless inflections of the human vioce, and the rapidity with which sounds may be uttered and varied. The mobility of the fingers is scarcely less remarkable than that of the organs of speech, and is fully displayed in the rapid movements performed by a skilful musician. The upper extremities have a greater range and variety of action than the lower. The lower extremities exhibit, as in dancing, greater promptitude

and diversity of action than the trunk. The muscles at the fore part of the neck have more mobility than those at the back of it, being chiefly employed in giving motion to the head, while the latter support it. Thus the order is inverted in respect to mobility and perpetuity of contraction, or as the one rises the other descends in the scale.

The circumstance, however, from which this principle chiefly derives its importance is, that it prevails in the morbid as well as the healthy state; the same peculiarities that characterise each class of fibres in health continuing to predominate under the influence of disease. This we find illustrated in the examples of chorea and tetanus, or clonic and tonic spasm, being the two forms which increased mobility puts on, in the different orders of voluntary muscles.

Chorea, or St. Vitus' dance, which is characterised by frequent and irregular contractions, with the loss of power to steady and control the motions of the limbs, is the form under which morbid increase of mobility presents itself, in those organs most conspicuous for this property. Thus chorea is most apt to affect the muscles of the face, causing extraordinary twitchings or contorsions of the countenance: or the tendency to it appears first in the organs of speech, and produces stammering, which is a convulsive affection, of the nature of chorea. The muscles of the fore part of the neck are more liable to be affected in this way than those behind, and thus the power of controlling the motions of the head is lost, and they become shaking and irregular. The fingers are also liable to be affected, and the fore arm often to such a degree, that the hand cannot be carried to the head without moving in a zigzag line, or making a number of whimsical evolutions before it arrives there. The lower extremities are less apt to be affected in this way than the upper, the trunk still less than the limbs, and the muscles of the lower jaw rarely participate in this affection, though in extreme cases it may extend nearly to all parts.

Tetanus, or the tonic spasm, on the other hand, which is also characterised by increased mobility or tendency to inordinate action, is the form which this change assumes in the

organs least conspicuous for mobility, but most so for maintaining a state of permanent contraction. Accordingly the muscles of the lower jaw are liable to be affected in this way. Thus, trismus, or tremor of the jaw, before it becomes permanently fixed, is often the first indication of its approach. The retraction of the muscles of the cheek causing the risus sardonicus, is also a primary symptom. The muscles at the back of the neck are very liable to act in this way, drawing the head backwards: and frequently those of the trunk, the body being thus bent backwards into an arch, technically termed opisthotonos, or drawn forward in a contrary direction in the manner termed emprosthotonos. The muscles of the shoulder are more apt to be affected than those of the fore-arm, and thus the shoulders are drawn forcibly backwards. The lower extremities are more frequently affected than the upper, and the calves of the legs and the ball of the thumb are more liable to it than the muscles of the toes or the fingers.

Thus the phenomena of disease are diversified by the peculiarities of the organ affected, the muscles of each class retaining the same characteristics in the morbid, that distinguish them in the healthy state; or those remarkable for mobility present the phenomena of the clonic spasm; while those conspicuous for continuity of contraction are subject to that which is called tonic.

Proceeding from the animal to the automatic organs, destined to minister to the functions which support life, and nourish the body, we find them present a class of phenomena in many respects different from those hitherto considered.

Deriving their nerves chiefly from the gangliac system, and more remotely connected with the sensorium, their efforts are less liable to excite the sense of weariness, not requiring mental interference to regulate their motions.

Placed out of the jurisdiction of the will, and even beyond the power of the mind to distinguish the impressions ordinarily made upon them, they are endowed with a peculiar mode of sensibility, as formerly explained, which enables them to perform their functions automatically, being prompted to action by the impressions they receive.

These impressions proceed from the fluids which come in contact with them, mechanically distending their fibres as already shewn, and not from any specific quality which these fluids possess. No fluid, in its natural and healthy state, is irritating to the organ that secretes it; and when the contents of an organ are morbidly changed, its action is altered, and becomes morbid also.

In their ordinary efforts the involuntary muscles coincide with the manner in which the stimulus of distension is applied, and are less apt to fluctuate than those subject to the will, being nearly uniform in their degree, and regular in their periods of action. Each however presents a different modification of the moving power, connected with the peculiarity of its texture; and the knowledge of these varieties is essential to the explanation of their function.

The muscles of this class are not in general composed of large masses of fibres united into a compact body, and brought, by means of a tendon, to bear upon one point; but they are diffused or spread over the surface of their organ, sometimes in repeated layers. Their fibres are not disposed in straight lines running parallel to each other, and thrown simultaneously into contraction; but are curved and inflected in various directions, and different fibres are thrown into action successively.

The power they exert, if compared with that of the voluntary muscles, appears inconsiderable; as they do not act against a lengthened lever, but are immediately applied to their object, and effect their purpose, which mostly consists in the propulsion of fluids contained in cylindrical tubes or capacious vessels, with an effort proportioned to the resistance opposed.

The permanence of their exertion, though different in each organ, is at all times nearly uniform. Never called upon to perform those prodigious efforts common to the voluntary organs, they are endowed with powers nearly adjusted to the daily task allotted to them, which they accomplish without the sense of weariness announcing to the mind the changes

going on; and then usually undergo a spontaneous relaxation, and obtain a partial rest from their labours.

This spontaneous relaxation of involuntary organs, hitherto overlooked by physiologists, as far as the writer is aware, appears to be a fact as well established and as important in in its nature and consequences, as any in the science.

It is not the result of exhaustion, or want of power to act, as proved by the organ vigorously resuming its efforts, if roused by any extraordinary stimulus; but is perfectly spontaneous, and by anticipating the period of exhaustion, seems intended to prevent its occurrence.

The period of its arrival, like that of the sense of fatigue in the voluntary muscles, varies in different organs. In one it occurs after the exertion of an hour, while another continues its efforts for four hours, and a third for twelve; circumstances which, as well as the mode of action, require to be illustrated by the separate examination of each.

The action of the muscles of respiration is simple in its nature, consisting of contraction and relaxation alternately succeeding each other. The fibres of the diaphragm, which are chiefly instrumental in performing this office, contract simultaneously like those of a voluntary muscle, exerting an effort apparently equal to that which is required in using a common pair of bellows; and this is continued through life, without any other intermission than the short pause between each inspiration. A periodical diminution of their action is all they appear to enjoy.

Yet respiration, though decidedly an automatic function in Bichât's classification, depends upon the cerebral system, and owes its regular continuance to the impression communicated to the sensorium from the blood accumulating in the lungs. Hence arises the ready participation of the respiratory organs, when any thing powerfully affects the mind, or acts physically upon the brain; witness the sighing and interrupted respiration in grief, the convulsive action of the diaphragm in laughter, and the slow laborious breathing occasioned by pressure on the brain in apoplexy. The impression that ex-

cites respiration is increased by exercise, which accelerates the return of blood to the lungs, and therefore quickens the breathing. This stimulus is partly abstracted by rest, which retards the returning blood, and by sleep, which impairs the sentient power of the brain, and hence these circumstances retard the breathing. Thus, the respiratory organs, as well as others, experience a partial relief from their task at stated periods.

The sense of fatigue is unknown to them, unless the pain in the side, succeeding to excessive laughter, or violent running, be of that nature; but a disposition to relax is observable as sleep approaches. Thus the full and deep respiration that accompanies a yawn, denotes that their office is inadequately performed, and a congestion thereby occasioned in the lungs, which calls for the aid of the intercostal muscles in making a more effectual effort to obtain relief.

The action of the digestive organs is less simple, but varies in different parts of the alimentary canal.

The stomach, furnished with both longitudinal and transverse fibres, has two distinct modes of action: one is termed its peristaltic motion, and consists in the successive contraction of its transverse fibres, by which its contents are continually propelled on towards its lower orifice, the pylorus. The other consists in the progressive and uniform contraction of all its fibres together, by which its bulk keeps gradually diminishing, until it has passed from its greatest distension to the opposite extreme of contraction.

The range of action embraced by the stomach far exceeds that of any other involuntary organ; and the period it occupies in passing through its stages usually extends to four or five hours.

Though digestion is also an automatic function, yet it is requisite, for obvious reasons, that the mind should have notice at certain periods, of the changes that take place in the stomach; and accordingly its nerves in part proceed from the sensorium, and at a particular stage of digestion, awaken the sense of hunger.

The period of its occurrence bespeaks the nature of this sensation. It arises when the organ approaches the state of extreme contraction; and this appears to be the cause that excites it. Accordingly it subsides as soon as food is taken, for the organ is thereby disposed to relax, and remains for a time in a state of quiescence.

The disposition to relax after a certain period of exertion, common to the stomach along with other involuntary organs, though promoted by taking food, often occurs spontaneously, and thus affords further proof of the cause of hunger; for after fasting much longer than usual, hunger subsides as soon as the action of the organ is suspended, and is only renewed when the distension occasioned by the evolution of air stimulates it to a renewal of its efforts.

When action is renewed with the stomach empty, the sense of hunger quickly recurs, because the air is soon expelled, and the organ at once returns to the state of extreme contraction. But after it is filled with food, hunger returns more slowly, for it now passes through the stages of action progressively, and arrives by slow degrees at the state of extreme contraction.

The successive stages of action may be traced almost as distinctly in this as in the voluntary organs. When relaxation ceases, and its efforts are renewed, its action at first must needs be moderate, or its contents would be thrown up into the œsophagus, a slight degree of contraction sufficing to expel a portion of them through the pylorus, when the organ is nearly full. This then constitutes the first stage of action. As digestion proceeds its activity increases, and the second, or stage of energetic action now arrives. At length it approaches the state of painful contraction, producing the sense of hunger, and this constitutes the third stage, after which the spontaneous relaxation succeeds as before stated.

The rest which the stomach enjoys after eating is not the only remission of its action that occurs. This organ is evidently less active during sleep; for although supper and breakfast are usually the lightest meals, twelve or fourteen

hours elapse between them, while the space of four or five is sufficient, during the day, to empty the organ, and excite the returning sense of hunger.

The action of the small intestines is more limited in extent than that of the stomach, being confined to their peristaltic motion, which slowly propels their contents.

This action becomes less marked towards the termination of the alimentary canal, and is scarcely perceptible in the colon, which passively yields to the fœcal matter, and suffers it to accumulate until the load becomes burdensome, or the distension irksome; and then, like other organs, it exerts an effort of resistance. Furnished with longitudinal bands, as well as transverse fibres, it propels its contents on towards the rectum, and this organ, assisted by the co-operation of the abdominal muscles and diaphragm, obtains occasional relief from its burthen by the expulsion of its contents.

In those organs which are furnished with sphincters, as the stomach, rectum, and bladder, the act of depletion depends as much upon the state of the sphincter, as upon the action of the organ; or at least they must act in concert to accomplish their purpose.

The sphincters composed of strong muscular rings, forming the orifice through which the contents of the organ must pass, regulate the transmission or retention of the matters contained, and constitute a most essential class of moving fibres, notwithstanding which their nature and mode of action have been little noticed by physiological writers.

Their chief peculiarity appears to consist in this, that their action alternates with that of the organ to which they appertain, the sphincter relaxing when the organ contracts, but remaining contracted while the organ is relaxed. Thus, when the stomach, after taking food, remains for a time relaxed and quiescent, so long its sphincter, the pylorus, continues contracted, and suffers none of the chyme to be transmitted: but when the stomach, having rested, renews its efforts, the pylorus then relaxes, and suffers the residuum of the chyme, not taken up by absorption, to be transmitted to the intestines. So also the sphincter of the rectum remains perma-

nently contracted, and suffers nothing to escape, so long as the canal above continues passive; but when the organ itself makes an effort of contraction, then the sphincter relaxes, and transmits its contents. In like manner, while the urinary bladder continues relaxed, and suffers its contents gradually to accumulate, so long its sphincter remains contracted, and prevents their escape; but as soon as the organ makes an effort for their expulsion, then the sphincter relaxes and micturition ensues.

Whether this relaxation be mere passive distension, occasioned by the contraction of the organ propelling onwards its contents, or whether, like other involuntary organs, the sphincters have certain periods at which they are disposed to suspend their efforts, and yield spontaneously, may be uncertain, but the effect is the same in regard to depletion of the organs.

At all events they do not relax from exhaustion, or want of power to remain contracted; for although they yield when the distending force is moderately applied, yet if suddenly or inordinately distended they become obstinately constricted again. Thus digestion is impeded by constriction of the pylorus, if the stomach is overdistended with food; thus, the sphincter of the bladder remains constricted, and strangury arises from long retention of urine; and, in the same way, the sphincter of the rectum becomes spasmodically contracted, and obstinate constipation arises from immoderate accumulation of fæces.

We have now to consider the organs of circulation, which are of the first importance in physiological research, as the vital powers of every organ, and the condition of every function immediately depend upon the vascular system.

The organs of circulation consist of the heart and arteries, the veins and capillaries; each of which has different powers, and a different task allotted to it. The heart dispenses the blood, containing the materials of nutrition, to all parts. The capillaries receive, employ, and consume it. The arteries and veins do little more than transmit it unchanged, or perform the office of mere carriers.

The heart is the most powerful of the involuntary organs,

exerting an effort, according to Hale's calculation, capable of raising a weight of 50lbs. or more, at every contraction, and repeating this effort about seventy times in a minute. If such an effort, which is small however compared to that of many voluntary muscles, were proved to be exerted while the body is erect and in action, one far less considerable will suffice to keep up circulation, while it is at rest, and in the recumbent posture. The blood flowing on a level will now require little force to keep it in motion; and thus the heart also obtains a remission of action during sleep. Besides, the effort required from the heart depends upon the resistance the blood meets in the capillary vessels, and these being also relaxed during sleep, suffer its transmission more easily, and thus afford to the heart a state of comparative rest.

The slowness of the pulse clearly proves a diminution of its activity; and whether this arise from the partial abstraction of the stimulus that excites it to action, or from a tendency to spontaneous relaxation in the organ, it equally affords a degree of repose.

The recumbent posture certainly withdraws a part of the stimulus, by removing the weight of the incumbent column of blood, descending from the head and distending the heart, and may thus retard circulation, and dispose to sleep. But other considerations favour the conclusion that the heart is naturally disposed to a periodical remission of its effort.

Thus the diurnal fluctuations of the pulse, noticed by Haller, Whytt, Hunter, and others, who agree in stating it to be comparatively slow and languid in the morning, fuller and stronger about mid-day, with increasing frequency towards evening, clearly denote the successive stages of action, and render it the more probable that the retardation which follows, is the natural effect of the same tendency to spontaneous relaxation or remission of action in the heart, which is observable in other organs.

Whether the arteries have any muscular fibres, has long been a disputed point. The physiological arguments of Bichât, and the chemical researches of Berzelius, militate so

strongly against it, that their existence seems to be now generally doubted, and their contractility ascribed rather to elasticity of texture. In that case they must be regarded as passive in the function of circulation, suffering the transmission of their contents without assisting in their propulsion ; or at most only contributing by their elasticity to equalize the flow of the blood.

The veins undergo occasionally very extensive changes, but they seem also passive in their production. Thus they are distended whenever the force of circulation is increased, and they gradually recover their former state of contraction when the distending force is withdrawn. In the same way they are affected by causes that act physically upon them ; thus they are relaxed by warmth, and constricted by cold, suffering rather than producing the changes in question.

Whatever doubts may be entertained of muscular contractility prevailing in the veins and arteries, its existence cannot be questioned in the minute vessels termed capillaries.

These may be distinguished into different classes, some circulating red blood, others serum, and others again only lymph. But the condition of each is so liable to vary, that the fluids common to one class gain at times admission into another.

Such changes are observable in the effects of local irritation, which cause a more abundant afflux of red blood to the part affected ; in the sudden paleness or redness of the face from fear or shame ; in the copious flow of tears or saliva, and other changes of secretion which often present a complete alteration in the quantity and quality of the secreted fluid.

These effects, being for the most part local, or circumscribed to a particular spot, cannot be referred to altered action of the heart, which would equally affect all parts ; but must proceed, as shewn by Dr. Whytt in his Physiological Essays, from an active power in the vessels themselves, which enables them to vary their state of contraction when affected by particular causes.

The nature of these causes also proves their action to be

filamenta coronâ inclusa atque infra os tubi inserta sint. Seminum testa *in loculamentis polyspermis nigricans.*

SPECIES.

I. *Floribus petiolatis v. subsessilibus: limbo radiato: exicuris senis coronæ staminiferis.*

1. *zeylanicum.* P. uniflorum; foliis ligulato-lanceolatis, laciniis limbi longioribus tubo, staminibus incurvo-conniventibus.
   Pancratium zeylanicum. *Linn. sp. pl. ed.* 2. 1. 417. *Willd. sp. pl.* 2. 41. *Hort. Kew. ed.* 2. 2. 218.
   Pancratium tiaræflorum. *Salisbury parad. lond.* 86.
   Narcissus zeylanicus, flore albo hexagono odorato. *Herm. lugdb.* 691. *t.* 693. *Comm. hort.* 1. 75. *t.* 38.
   Lilium javanicum. *Rumph. amboin.* 6. 161. *t.* 70. *f.* 2.
   Bulbus globosus diametro sesquiunciali. *Folia* bifaria, 10—12, acuta, 6—12-uncialia. *Scapi* foliis breviores, subcompressi. *Flos* magnus, albus, remissè fragrans, vesperi expandens, manè emarcescens. *Spatha* arida, æqualis tubo. *Tubus* cylindricus; *laciniæ limbi* lineares revolutæ. *Corona* subrotato-patens lobulis 12 acutis. *Stamina* vix æquantia limbum. *Ex angl. Roxb.*
   Patria: Zeylona; Insulæ Moluccanæ. Horto Botanico Calcutta cultum.

2. *longiflorum.* P. uniflorum; foliis angustè lanceolatis; corollæ laciniis lineari-lanceolatis, duplo brevioribus tubo; staminibus conniventibus parùm longioribus lacinulis coronæ gibboso-campanulatæ.
   Folia saturatè viridia, pedalia, unciâ angustiora. *Scapus* foliis vel et interdùm tubo corollæ plurimùm brevior, compressus. *Flos* grandis, albus, fragrans; *tubus* sesuncialis, pallidè virens, levitèr sulcatus; *limbi laciniæ* lineari-lanceolatæ, triunciales: *corona* gibbosa dentibus acutis patentibus. *Antheræ* majusculæ. *Ex angl. Roxb. corom. ined. Mus. Banks.*
   Patria: Moluccæ.

3. *verecundum.* P spatha 2—4-flora, foliis linearibus acutis,

limbo corollæ breviore tubo, coronæ incisuris alternè profundioribus, staminibus incurvis 2—3plo longioribus lobulis coronæ. *Ex angl. Roxb.*

Pancratium verecundum. *Solander in Hort. Kew.* 1. 412; *in editione secundâ omissum. Willdenovio aliisque malè cum* maritimo *confusum*).

Pancratium triflorum. *Roxburgh corom. ined. in Mus. Banks. cum tab. pict.*

Catulla pola. *Rheede malab.* 11. 79. *t.* 46.

Sada canoor. *Hindû.*

A Roxburghio distinguitur *maritimo* foliis numerosioribus non glaucis, acutè acuminatis, nec exactè bifariis, dentibus coronæ undulatis longioribus magìsque acuminatis, filamentis bis terve altioribus lacinulis coronæ.

Folia (8—10) sesquipedalia, semunciam lata. *Scapus* erectus, compressus, pedalis. *Spathæ* oblongæ, lanceolatæ, acuminatæ, albidæ, marcescentes, exteriores majores sesquiunciales. *Flores* suaveolentes, pedicellati. *Pedicelli* trigoni, vix semunciales. *Corollæ tubus* cylindrico-trigonus, virescens, vix biuncialis, crassitie pennæ anserinæ. *Limbus* campanulatus: *laciniæ* lanceolatæ acutæ, tubo paulò breviores, niveæ, extùs medio virescentes. *Corona* campanulata, corollæ laciniis brevior, sexfida, laciniis bifidis. *Filamenta* alba. *Antheræ* flavæ. *Stylus* declinatus, virescens. *Solander.*

Patria: India orientalis.

4. *maritimum.* P. pluriflorum; foliis infernè vaginantibus, glaucissimis, acumine obtuso; coronâ longè accretâ limbo turbinato; antheris introrsùm deflexis.

Pancratium maritimum. *Linn. sp. pl. ed.* 2. 1. 418. *Cavan. ic.* 1. 41. *t.* 56. *Hort. Kew.* 1. 411. *ed.* 2. 2. 219. *Salisbury in trans. linn. soc.* 2. 70. *t.* 9. *Redouté liliac.* 8. *Desfont. atl.* 1. 283. *Lam. et Decand. fl. franç.* 3. 230. *Flor. græc. t.* 309. *Willd. sp. pl.* 2. 42; (*exclusis* verecundo *et* caroliniano *cum synonymis Catesbæi Commelini et Rumphii*). *Nob. in Botanical Regist.* 2. 161. *cum. ic.*

Pancratium marinum. *Ger. emac.* 173 3.

Pseudonarcissus marinus albus, Pancratium vulgò. *Park. parad. t.* 107. *fig.* 5.

Hemerocallis valentina. *Clus. hist.* 1. 167.

Bulbus subglobosus. *Folia* plurima (8), lorata, concaviuscula, subbifaria, longiora scapo, estriata, dorso convexa, ecarinata, semunciam lata. *Scapus* sesquipedalis, compresso-teres, glaucus, estriatus. *Spatha* arida, lanceolata, 4plo brevior umbellâ. *Flores* 2—7 v. plures, subsessiles pedunculis brevissimis crassis, longi, albi, fragrantissimi. *Germen* oblongum, rotundatè 3-gonum, glaucum. *Tubus* 3—4-uncialis, virens, dilatatus in faucem; *limbus* brevior tubo, laciniis recurvo-radiatis, lineari-lanceolatis longissimè adnatis coronæ; *interioribus* sublatioribus ad latera tenerioribus et subdiaphanis, tantummodò à striâ mediâ externè virentibus; *exterioribus* extùs totò viridibus; *corona* ampla, ¼ parte brevior limbo, 12-dentata, dentibus ovato-angularibus æqualibus. *Filamenta* conniventia, haud multùm longiora dentibus intermediis; *antheræ* verticales, intiorsùm deflexæ, luteæ. *Stylus* parùm brevior corollâ; *stigma* punctum acutum.

Patria: Mauritania, Oriens, Hispania, Italia, Gallia meridionalis

5. *carolinianum.* P. multiflorum; foliis non glaucis? non infernè vaginantibus; antheris supinato-incumbentibus. *Tab.* 3. *fig.* 1. (*Ex prototyo in Museo Banksiano*).

Pancratium carolinianum. *Lin. sp. pl. ed.* 2. 1. 418. *Walter fl. carol.* 120. *Hort. Kew.* 1; (*in editione secunda omissum*).

Pancratium maratimum. *Pursh amer. sept.* 1. 222.

Pancratium spatha multiflora, foliis linearibus, staminibus nectarii longitudine. *Miller dict. ed.* 7. *n.* 6.

Lilio-Narcissus polyanthos, flore albo. *Catesby carol.* 3. *p.* 5. *tab.* 5.

Difficiliùs ex iconibus et speciminibus siccatis a *maritimo* distinguendum. Non ità fortè plantis in vivo collatis. At character quem desumpsimus antherâ, certus et constans, quandò ex siccis et iconibus judicare liceat

Subjungimus iconem plurimis abhinc annis ad plantam Horto Kewensi floridam effigiatam, atque manû certissimâ Dryandri subsignatam titulo PANCRATII *caroliniani.*

6. *canariense.* P. pedicellato-multiflorum; foliis lanceolato-loratis, glauciusculis, obtusulis; tubo bis breviore limbo, filamentis dentes coronæ non exsuperantibus.

Pancratium canariense. *Nob. in Botanical Register v.* 2. 174.

Bulbus globosus. *Folia* plura deorsùm cylindraceo-vaginantia, indè erecto-patentia, elongatè lorata, infern subarctata, obsoletè striata acumine obtuso, sesquipedalia v. altiora, ubì latiora sesquiunciam transversa. *Scapus* lateralis, compressus, glaucus, pauld̀ brevior foliis. *Spatha* arida, lanceolata, cuspidata, longior pedunculis. *Flores* 7—8, erecti, albi, remissè odori: *pedunculis* parùm brevioribus. *Germen* haud multò brevius tubo, angustè oblongum, triquetrum, duplo crassius pedunculo; ovulis numerosis in loculo singulo biseriatis. *Corolla* sesquiuncialis v. parùm altior; *tubus* virens, angustus, sexsulcus, trigonus; *limbus* stellatus infrà brevè conferruminatus cum coronâ, laciniis angustis lanceolatis, duplo longioribus tubo, 3 extimis latioribus: *corona* $\frac{1}{3}$ parte brevior limbo, turbinata, patula, inciso-dentata, dentibus 12 angulari-acuminatis æqualibus integris. *Stamina* conniventia, brevissima; *antheræ* luteæ lunulatæ, vibratæ, æquales vel longiores filamentis. *Stylus* inclinatus, firmulus, æquans florem: *stigma* obtusum, parùm tumidum.

Patria: Insulæ Canarienses.

7. *illyricum.* P. multiflorum; foliis loratis cæsiis, scapo variçosè nervoso ancipiti, laciniis lanceolatis convexis longioribus tubo; corona brevi fissuris staminiferis profundissimis.

Pancratium illyricum. *Linn. sp. pl. ed.* 2. 1. 4. 18. *Mill. dict. ed.* 8. *n.* 2. *ic.* 2. 132. *t.* 197. *Hort. Kew.* 1. 411. *ed.* 2. 2. 220. *Nob. in Curtis's magaz.* 718. *Redouté liliac.* 153.

Pancratium stellare. *Salisbury in trans. linn. soc.* 2. 74. *t.* 14.

Lilionarcissus Hemerocallidis facie. *Clus. hist.* 167, 167. *Besl. hort. eyst. vern.* 3. *t.* 16. *f.* 1.

Narcissus tertius Mathioli. *Park. parad. t.* 97. *f.* 1.

Bulbus globosus in collum productus, integumentis multiplicibus nigro-fuscis. *Folia* septena plurave, lorata, carinata glauca acumine obtuso, plùs minùs 2 uncias transversa, firma. *Umbella* 10—30-flora subpedunculata, *pedunculis* brevioribus germine; *flores* albicantes v. subochroleuci, odori. *Corolla* 2 uncias cum dimidio alta; *tubus* duplo longior germine, trigonus, virens; *limbus* stellatus, laciniis ovali-lanceolatis, lateribus depressis. *Filamenta* triquetro-subulata, erecto-divergentia. *Corona* ter quater brevior limbo, fissuris interstamineis brevibus, dentibus subulatis. *Stylus* æquans corollam, filamentis plurimùm gracilior. *Capsula* oblonga, trigona; *semina* ex rotundis contactû angulosa cum testâ nigrâ.

Patria: Europa australis; Hispania, Sicilia, Corsica.

8. *parviflorum.* P. pluriflorum; foliis ligulatis, canaliculatis; scapo ancipiti; floribus sesquiuncialibus; filamentis basi dilatatis, distinctis, bidentatis in coronam sexpartitam approximatis.

Pancratium parviflorum. *Redouté liliac.* 8. 471.

Bulbus ovato-globosus, in collum productus. *Folia* subquaterna, pallidè virentia, dorso convexa absque nervo medio, pedalia, transversè 9-linearia. *Scapus* tereticompressus, anceps, glaucus, nervoso-striatus, subbrevior foliis. *Umbella* subsexflora, inæqualitèr pedunculata. *Spatha* arida, valvis acies scapi decussantibus. *Corollæ tubus* viridis, subtriqueter, æqualis limbo: *laciniæ* stellatæ, lanceolatæ, 9 lineas longæ, 3 lineas latæ, albæ, semidiaphanæ, medio crassiores opacæ extùsque striâ dorsali virentes, lateribus depressæ; *exteriores* hamato-mucronatæ, sublongiores. *Filamenta* erecto-patentia, ⅓ breviora limbo, filiformi-attenuata, basi membranâ brevi utrinque unidentatâ alata fermè ac in

ORNITHOGALIS plerisque, indè *corona* sexpartita partibus collaterali-contiguis, nec ut sæpiùs concretis. *Antheræ* incumbentes, oblongæ, albidæ, defloratæ minimæ. *Stylus* corollæ æqualis, curvulus: *stigma* punctum simplex. *Germen* trigono-rotundum, faciebus interangularibus sulco notatum. *Illyrico* proximum.

Patria: ignota. Horto Parisino sub dio vigens. Ex signis nonnullis ORNITHOGALO nutanti *accedens.*

9. *amboinense.* P. multiflorum; foliis petiolatis plurifariis lamina cordato-orbiculata nervis distantibus concentricè costata; corona semisexfida, 12-dentata, 4-plo breviore limbo.

Pancratium amboinense. *Linn. sp. pl. ed.* 2. 1. 419; (*exclusa var. β. cum synonymo Trewii*). *Hort. Kew.* 1. 413. *ed.* 2. 2. 220. *Willd. sp. pl.* 2. 45. *Nobis in Curtis's magaz.* 1419. *Redouté liliac.* 384.

P. nervifolium. *Salisbury parad. londin.* 84.

Crinum nervosum. *L'Heritier sert. angl.* 8. *Willd. sp. pl.* 2. 47.

Narcissus amboinensis, folio latissimo rotundo, floribus niveis inodoris. *Hort. Amstel.* 1. 77. *t.* 39.

Cepa sylvestris. *Rumph. amboin.* 6. 160. *t.* 70. *f.* 1.

Bulbus globosus integumentis pallidis. *Folia* petiolo semicylindrico concavo, laminâ sæpè transversè latiore, suprà nitida et immersè nervosa, acumine brevi, periphæriâ depressâ. *Spatha* albicans. *Umbella* pedunculata, pedunculis brevioribus flore. *Germen* ellipticum, obsoletè trigonum, læve, loculis collaterali-dispersmis. *Corolla* alba, subtriuncialis: *tubo* stricto, rotundatè trigono, levissimè dilatescente, viridiusculo, laciniis pauló longiore; *limbo* stellato, laciniis extimis pauló angustioribus lanceolatis, intimis spathulato-lanceolatis, suprà subrhombeo-ovatis. *Stamina* subdeclinato-patentia, ¼ parte breviora limbo. *Filamentorum* alæ breves basilares partìm tantùm connatæ in coronam brevissimam. *Stylus* albus; *stigma* punctum obtusum, puberulum.

10. *ringens.* P. foliis lorato-subulatis, canaliculatis; limbo nutante irregulari; staminibus declinatis.

Pancratium ringens. *Ruiz et Pavon flor. per.* 3. 53. *t.* 283.

Bulbus subrotundus. *Folia* bifaria, acuminata, superna divergentia, obscurè viridia, avenia. *Scapus* bipedalis, anceps, erectus, longior foliis. *Spatha* subquinqueflora; *floribus* sessilibus, *bracteis* membranaceis albicantibus sublanceolatis interstinctis. *Tubus* brevis, viridis; *limbi laciniæ* albæ lineares, reflexæ, sesquipollicares, lineâ dorsali viridi, 4 supernè proximiores, 2 infernè. *Corona* cylindraceo-campanulata, assurgens, albo-virescens, limbo 4-plo brevior, 12-dentatus, margine retroflexo. *Filamenta* limbo æqualia, patentia, deflexo-incurvata, alba: *anth.* luteæ. *Stylus* staminibus longior albus. *R. et P.*

Colitur in hortis peruvianis.

11. *Amancaes.* P. pluriflorum; foliis infrà fistuloso-vaginantibus suprà elongato-lanceolatis; tubo æquante limbum stellatum nutantem, corona inæqualitèr 12-fida, subisometra laciniis, margine denticulato; staminibus brevibus infracto-conniventibus.

Pancratium Amancaes. *Nob. in Curtis's magaz.* 1224. *Hort. Kew. ed.* 2. 2. 218.

Narcissus Amancaes. *Ruiz et Pavbn fl. peruv.* 3. 5. *t.* 283. *fig. a.*

Bulbus ovatus. *Folia* 3—5, bifaria, altè vaginantia et dimidiato-membranosa, bipedalia v. longiora, medio canaliculata, maximum 2 uncias lata. *Scapus* bis tripedalis v. circitèr, compressus, anceps. *Spatha* arida, ovato-cuspidata. *Flores* 3—6, aurei, nunc brevè pedunculati, subsesunciales, odoratissimi. *Germen* ovato-3-quetrum viride, tubo pluriès longiore continuum. *Tubus* triqueter, curvus, virens, carnosus: *limbus* 3-uncialis, radiato-explanatus, laciniis æqualibus tubo, lanceolatis, longè acuminatis, distantibus. *Corona* magna, limbi parùm longioris concolor, campanulata, transversè latior, fissuris alternè angustioribus, latioribus staminiferis, radiis senis viridibus intùs infra stamina

picta. *Filamenta* aurea, robusta, tereti-subulata, fissuris sublongiora, 3 introfracta, 3 ima subadscendentia: *antheræ* incumbentes, obliquæ, subsagittatæ. *Stylus* albicans, trigono-filiformis, crassior filamentis. *Stigmata* 3, brevia. *Semina* bulboso-laxata.

Patria: Peru; in collibus Lima adjacentibus. Brasilia?

12. *calathinum.* P. 1-pluriflorum; spatha herbacea; limbo erectiusculo turbinato-campanulato parùm breviore tubo obtusè triquetro stricto; coronâ elongato-campanulatâ haud multùm breviore limbo. *Nobis in Botanical Register: tab.* 215.

Pancratium calathiforme. *Redouté liliac.* 353.

Pancratium narcissiflorum. *Jacq. fragm.* 86. *n.* 270. *t.* 138.

Folia subsena, longè deorsum fistuloso-vaginantia, suprà lorato-lanceolata, acuminata, plana, breviora scapo, 1—2 uncias lata. *Scapus* compresso-anceps, sesqui-bipedalis. *Spatha* æqualis tubo, lanceolata, obtusa, erecta. *Flores* sessiles, infundibuliformes, albi, fragrantissimi. *Tubus* triuncialis v. ultrà virens: *limbus* albus, supernè recurvus, totus a coronâ discretus; laciniis angustis ligulato-lanceolatis, carinatis, infernè involuto-canaliculatis. *Corona* alba, campanulato-cylindracea, transversè latior, sexiès excisa, excisuris staminiferis, lobis rotundatis eroso-denticulatis medio fissis; intùs radiis senis viridibus infra stamina striata. *Stamina* æqualia lobis coronæ, 3 suprema introfracta, 3 inferiora inflexo-conniventia; *filamenta* alba subulata; *antheræ* polline vitellino flavicantes. *Semina* bulboso-laxata.

Patria: Brasiliæ.

13. *nutans.* P. pauciflorum; foliis obtusis; spatha arida; corolla nutante; tubo plurimùm breviore limbo radiato; antheris longioribus filamentis.

Pancratium calathinum. *Nobis in Curtis's magaz.* 1561; (*excluso synonymo Redoutæi*).

Folia bipedalia v. ultrà, lorato-elongatis, infernè involuto-concavis. *Flores* subtrini, albi, subtriunciales, sessiles,

nutantes ad cernuos, fragrantes. *Scapus* compressus, anceps. *Spatha* acuminata. *Germen* indefinitè polyspermum. *Tubus* rotundatè 3-gonus, striatus, virens: *limbi laciniæ* lanceolato-lineares, concavæ, angustæ. *Corona* istis ex ¼ parte circà brevior, turbinato-campanulata, limbo penitùs discreta, 6-lobato-excisa excisuris staminigeris, corrugato-plicata, lobis dentato-laceris. *Stamina* incurvo-conniventia, vix excedentia lobos collaterales: *antheræ* verticales, à dorso appensæ, tremulæ, sublongiores *filamentis* subulatis. *Stylus* æquans florem suprà virens: *stigma* obtusum, obsoletè 3-lobulatum. Anteà habuimus pro varietatem *calathini*, at plantis collatis in vivo non dubitamus separare.

Patria: Brasiliæ.

II. *Floribus sessilibus v. subsessilibus: limbo radiato: dentibus senis coronæ staminiferis.*

14. *undulatum* P. sessili-multiflorum; foliis petiolatis ellipticis, brevitèr acuminatis; scapo compresso; laciniis linearibus undulato-crispis, coronæ sinubus unidentatis *Kunth nov. gen. et spec. nov. orb.* 1. 222. (*Specimen è Guianâ, horto Kewensi floridum in Herbario Banksiano absque nomine.*

Lyrio hermoso. *Colonis.*)

Folia Hemerocallidis *cæruleæ*, succulenta, reticulato-nervosa, glabra, lætè viridia, subsesuncialia latitudine 4-unicali magisve: *petioli* 4-unciales, canaliculati. *Scapus* pedalis, compressus. *Flores* sessiles, albi, suaveolentes, subnovemunciales: *tubo* tenui viridi, cylindraceo? 5-unciali: *limbo* patente. *Stamina* breviora limbo: *corona* 12-fida, laciniis 6 alternis staminiferis: *antheræ* lineares. *Germen* ovatum, 3-gonum: *stylus* exsertus: *stigma* subcapitatum. *Id. ad siccum.*

Patria: America meridionalis; Venezuela, in humidis ad ripam fluminis Tiù propè la Vittoria et in littore lacus Taccariguensis.

15. *littorale.* P. multiflorum; foliis plurimis elongato-loratis angustis utrinque attenuatis; tubo tereti bis longiore limbo, corona plicata quater ferè breviore laciniis linearibus.

Pancratium littorale. *Jacq. amer.* 99. *t.* 179. *f.* 94. *Jacq. hort. vindob.* 3. 41. *t.* 75. *Hort. Kew.* 1. 412. *ed.* 2. 2. 219. *Salisbury in trans. linn. soc.* 2. 74. *t.* 13. *Willd. sp. pl.* 2. 43. *Ruiz et Pavon fl. peruv.* 3. 53. *Kunth nov. gen. & spec. nov. orb.* 1. 222.

Pancratium distichum. *Curtis's magaz.* 1879.

P. foliis ensiformibus, spatha multiflora, floribus magnis candidis fragrantibus. *Trew ehret.* 6. *t.* 27.

Pilillas. *Colonis.*

Bulbus globosus. *Folia* bifaria, bipedalia et longiora latitudine sesquiunciali v. ultrà, nitida, striata, medio canaliculata. *Scapus* 1—2-pedalis, anceps, glaucus. *Spatha* arida. *Flores* 4—10, sessiles, 8—10-unciales v. longiores, candidi, Vanillæ odore fragrantes. *Tubus* teres, infra virens, rectus 69-uncialis. *Laciniæ limbi* lineari-lanceolatæ radiato-reflexæ. *Corona* infundibuliformi — campanulata margine inæqualitèr dentata. *Filamenta* subæquantia limbum, patentissima, viridia. *Antheræ* vitellinæ, semunciales.

Patria: America meridionalis; insulâ Tierra Bomba. Jacq. In maritimis arenosis inter Portobello et Carthagena de Indias. Kunth.

16. *Dryandri.* B. foliis lanceolato-loratis, laciniis parùm brevioribus tubo, quinquiès longioribus coronâ: sinubus interstamineis subrepandis.

Pancratium littorale β. *Nobis in Curtis's Magaz.* 825; (*exclusis synonymis*). *Redouté liliac.* 154.

Pancratium littorale β; tubo corollæ breviore quam in (α) quadriunciali; limbi laciniis tubo parùm brevioribus, nectario adnatis. *Dryander MSS. in Musæo Banksiano.* Vix dubitandum est quin *littorali* separari oporteat. Omisit Dryander in editione secundâ Horti Kewensis quia incertus.

Patria: non nota.

17. *angustum* P. pluriflorum; foliis loratis longè acuminatis lucidis; tubo rotundatè trigono estriato; laciniis isto sublongioribus divaricatis a coronâ triplo breviore angustè infundibuliformi omninò discretis.

Pancratium angustum. *Nobis in Botanical Register.* 221; *cum ic.*

Folia lætè virentia, plurima, bifariàm divaricata, sesquipedalia v. ultra, sesquiunciam lata. *Scapus* bipedalis, glaucus, anceps. *Spatha* arida, acuta. *Flores* quini, albi, sessiles fragrantes, in extensum sub-5-unciales: *tubus* virens ¼ parte v. circà brevior laciniis externis: *limbus* radiatus, recurvus, laciniis angustis, linearibus, extimis sublongioribus. *Corona* limbo ultra triplum brevior, spatiis interstamineis lobato—elevatis lobis acuminatis bidentatis v. bifidis, erectis. *Filamenta* erectiuscula, virentia duplo longiora coronâ, ⅓ parte v. circà breviora limbo: *antheræ* luteæ, ¾ partes unciæ longæ. *Stylus* virens corollâ brevior. *Germen* glaucum: loculamenta disperma, ovulis erectis oblongis affixis imo angulo loculamentorum.

Patria: non nota.

18. *rotatum.* P. bi-multiflorum; foliis pluribus lineari—loratis, obtusulis; spatha plurivalvi breviore tubo terete æquante limbum; corona turbinato-rotata infràttirgono-arctatâ, altiore filamentis.

Pancratium rotatum. *Nob. in Curtis's Magaz.* 827,1022. *Hort. Kew. ed.* 2: 2. 218. *Pursh Amer. sept.* 1.222.

Pancratium disciforme. *Redouté liliac.* 155.

Pancratium mexicanum. *Walt. carol.* 120. *Michaux bor. amer.* 1. 188.; (*nec aliorum, si pro subsequentis diversâ habeatur*).

α) biflorum. *Curt. mag. t.* 1082.

β) pluriflorum. *Curt. mag. t.* 827.

Folia suboctona semiunciam ad sesquiunciam lata. *Flores* albi, fragrantes præsertìm noctu, subsesunciales, sessiles, *limbo* radiato-explanato de coronâ omninò libero,

laciniis linearibus tubo tereti vix æqualibus. Agreste biflorum, cultum pluriflorum.

Patria: America; Carolinâ.

19. *mexicanum.* P. biflorum; foliis paucis, lineari-lanceolatis longè acuminatis; laciniis lineari-acuminatis; corona subrotato-turbinata longiore filamentis. *Tab.* 3. fig. 2. (*Ex delineatione in Musæo Banksiano*).

Pancratium mexicanum. *Linn. sp. pl. ed.* 2. 1. 418. *Hort. Kew.* 1. 410. *ed.* 2. 211. *Willd. sp. pl.* 2. 42.

Pancratium mexicanum, flore gemello candido. *Dillen. hort. eltham.* 229. *t.* 222. *f.* 289.

Adjecimus tabulam plantæ in Horto Kewensi floridæ pro *P. mexicano* à Dryandro habitæ. Differre videtur *rotato* antecedente foliis ferè de basi attenuatis longèque acuminatis, flore minore, limbi laciniis longè attenuatis, sublongioribus tubo, et ex coronâ basi breviùs arctatâ,

Patria: Mexico.

20. *caribæum.* P. multiflorum; foliis plurimis, lineari-oblongis lanceolatis; tubo trigono densè striato subduplo breviore limbo; corona arctiùs infundibuliformi duplo breviore staminibus, sinubus subunidentatis.

P ncratium caribæum. *Lin. sp. pl. ed.* 2. 1. 418. *Hort. Kew.* 1. 411. *Nob. in Curtis's mag.* 826. *et in notâ fol. vers.* 1467. *Willd. sp. pl.* 2. 42. *Id. in Hort. Berol. tab.* 73.

P. fragrans. *Willd. sp. pl.* 2. 42. *Hort. Kew. ed.* 2. 2. 219.

P. declinatum. *Jacq. amer.* 51. *t.* 102. *Hort. vindob.* 3 .11. *t.* 10. *Redouté liliac.* 414.

Narcissus totus albus latifolius major odoratus. *Mart. cent.* 3. *t.* 27.

Narcissus americanus flore multiplici albo hexagono odorato. *Hort. amstel.* 2. 173. *t.* 87.

Folia bifaria, 12—20, pedalia—sesquipedalia,—latitudine subtriunciali, infrà subduplo angustiora. *Scapus* pedalis v. ultrà, anceps, substriatus. *Spatha* arida.

Germen loculamentis collaterali-dispermis. *Flores* albi, sessiles, fragrantes. *Tubus* virens, 2 uncias parùm exsuperans; *laciniæ limbi* sub-3-unciales, lineares, pro longitudine coronæ turbinato-conniventes, indè radiato-recurvæ, dorso convexiusculæ. *Corona* triplo brevior limbo, dentibus interstamineis modò fissis, rariùs obsolescentibus. *Filamenta* ¼ circiter breviora laciniis, supernè virentia; *antheræ* vitellinæ. *Stylu* viridis. *Stigma* simplex. *Semina* in singulo loculo solitaria atque loculo conformia, tuberoso—carnosa.

Patria: India occidentalis.

21. *patens.* P. multiflorum; foliis lato-linearibus, floribus sessilibus, laciniis linearibus, rectiusculis, tubo longioribus, interioribus basi undulatis, corona obconica, intervallis staminum repandis. *Redouté liliac. 7. fol.* 414 *in notâ ad calcem textûs.*

Pancratium declinatum. *Redouté liliac. 6. t.* 380; (*excl. syn.*)

Differt *caribæo* ex foliis paucioribus admodùm angustioribus, florum odore intensiore, filamentis secundùm proportionem brevioribus, coronâ non inter stamina dentatâ, antheris pallidiùs flavescentibus, præprimìs undulatione basi laciniarum interiorum limbi. *Id. loc. cit.*

Patria: India Occidentalis?

22. *amœnum.* P. foliis pluribus ovali-lanceolatis, petiolo ter quatèr angustiore: umbella sessili divaricata: tubo breviore limbo.

Pancratium amœnum. *Salisbury in Linn. soc. transact.* 2. 71. *t.* 10. *Willd. sp. pl.* 2. 44. *Kew. ed.* 2. 2. 220. *Nobis in Curtis's magaz.* 1467.

Pancratium fragrans. *Redouté liliac.* 413.

Folia 6—8, subdecemuncialia, tranversè 3-uncialia, bifaria, petiolo lato subtriunciali, triplo ultràve angustiore laminâ. *Spatha* subherbacea: *bracteæ* parvulæ nec conspicuæ. *Flores* albi, odori. *Germen* subtrigibbum. *Tubus* 2 unciis longior, albo-virescens, laciniis ex unâ tertiâ parte circitèr brevior, rotundatè trigonus

subhexangularis. *Limbus* revoluto-radiatus, laciniis lanceolato-linearibus, subæqualibus, supernè versùs involuto-cuspidatis, exterioribus margine infernè sæpiùs subundulatis. *Corona* infundibuliformis, limbo penitùs discreta, sinubus interstamineis dente gemino. *Filamenta* viridia incurvo—divergentia, duplo altiora coronâ, ex unâ quartâ parte circitèr breviora limbo. *Antheræ* subulato-sagittatæ, basi sinû divisæ. *Stylus* æquans corollam: *stigma* viridissimum, capitellato-trigonum, puberulum, levissimè trifidum. Odor gratus at plurimùm remissior ac in *specioso*.

Patria: Guiana.

23. *ovatum*. P. compactiùs multiflorum; foliis ovalibus striatis utrinque attenuatis; tubo tereti estriato subæquali limbo, laciniis lineari-acuminatis infernè crispis; dentibus coronæ integris.

Pancratium ovatum. *Mill. dict. ed.* 6. (*Lond.* 1771. 4*to.*) *n.* 9. *Nobis in Botanical Register.* 43; *cum ic.*

P. amoenum. *Andrews's reposit.* 556? (*Non aliorum*).

P. amboinense. *β. Lin. sp. pl. ed.* 2. 1. 419.

P. foliis amplis ovatis acuminatis petiolatis, spatha multi flora staminibus nectario longioribus. *Trew ehret. t.* 28.

Folia plura, reclinata, bifaria, pedalia vel magìs, latitudine 4—6-unciali, basi in *petiolum* aliquotiès angustiorem pluriès breviorem parùm crassiorem attenuata. *Scapus* foliis æquilongus, complanato-anceps, glaucus, utroque margine membranaceo-extenuatus. *Spatha* 6—8-flora, herbaceo-albicans, plurivalvis, tubo brevior, erecta, valvis extimis oblongis obtusis. *Corolla* alba; *tubus* biuncialis, strictus, obsoletissimè trigonus; *laciniæ* recurvo-radiantes, exteriores subangustiores, vix lineas 2 latæ, viridi-mucronatæ; *corona* angusta, tubulato-infundibuliformis, ad usque basin limbo discreta, brevior staminibus. *Stamina* (pede limbi rata) $\frac{1}{5}$ parte breviora, laciniis, alba: *antheræ* graciles,

fulvæ. *Stylus* virens, æqualis corollæ: *stigma*, capitel lato-depressum.

Patria: India occidentalis. Insulæ Caribbeæ.

24. *speciosum.* P. foliis plurimis lanceolato-ellipticis cum acumine; petiolo crasso triplo breviore et multotiès angustiore laminâ: umbella subpedunculata: tubo fermè duplo breviore limbo.

Pancratium speciosum. *Salisbury in Linn. soc. transact.* 2. 73. *t.* 12. *Willd. sp. pl.* 2. 44. *Hort. Kew. ed.* 2. 2. 219; (*exclusis Botan. magaz. et Redouté liliac. quoad locos citatos). Nobis in Curtis's magaz.* 1453. *Redouté liliac.* 412.

Bulbus oblato-sphæricus, integumentis multiplicibus fuscentibus. *Folia* bifaria, obscurè virentia, sesquibipedalia, tranversè 3—4-uncialia: *petioli* semicylindracei. *Scapus* compressus, anceps, striatulus. *Spatha* chloroleuca, longior dimidio tubi. *Umbella* 7—15-flora bracteosa: *pedunculis* crassis subæquantibus germen. *Germen* ellipticum, rotundatè 3-gonum, loculamentis collaterali-dispermis. *Flores* candidi, in extensum 9-unciales, fragrantissimi præsertim vespere. *Tubus* triquetro-cylindricus, striatus, subduplo brevior laciniis. *Laciniæ* lineari-lanceolatæ, recurvostellatæ, lateribus deorsùm involutis; exteriores 3 sublatiores, hamato-mucronatæ. *Corona* turbinata, tranversè rugulosa, limbo penitùs discreta et ex $\frac{2}{3}$ partibus brevior, repando-excisa dentibus senis interstamineis subulatis, rariùs fissis vel obsolescentibus. *Stamina* incurvo-divergentia, sublongiora coronâ. *Stylus* paulò brevior corollâ, supernè virens; *stigma* capitellat o— 3-gonè, puberulum, intensum virens. Flores post annum siccati, odorati.

Patria: India Occidentalis.

25. *biflorum.* P. 1—3-florum; foliis lineari-cuneatis, tubo corollæ longo triquetro æquali laciniis limbi linearibus;

coronæ sinubus interstamineis erosis: filamentis longitudine coronæ.

Folia bifaria, 4—8, erecta, plana, obtusiuscula lineolis cancellata, pedalia latitudine unciali. *Scapi* breviores foliis, erecti, compressiusculi. *Flores* albi, remissè odori. *Spatha* 3—4-phylla, foliolis linearibus. *Tubus* albo-virescens, gracilis, 3—4-uncialis; *limbus* tandem recurvus, subæqualis tubo. *Corona* latè infundibuliformis, vix ⅓ partem limbi æquans. *Filamenta* divaricata: *antheræ* primo luteæ, indè fuscæ. *Stylus* altior staminibus; *stigmata* 3. *Ex Angl. Roxb.*

Patria: India Orientalis.

III. *Floribus petiolatis v. subpetiolatis, colore maximè ludentibus: tubo in faucem ampliato, v. limbo connivente: coronâ brevi latente.*

26. *coccineum.* P. pluriflorum; staminibus corollæ æqualibus, tubo tenui, laciniis limbi erectis.

Pancratium coccineum. *Ruiz et Pavon fl. peruv.* 3. 54. *t.* 285.

Pancratium croceum. *Redouté liliac.* 187. *Persoon syn.* 3. 351.

Pancratium limense. *Vélins du mus. d'hist. nat. de Paris.*

Bulbus subrotundus. *Scapus* subspiralis, pedalis et ultrà, levitèr striatus, solidus. *Folia* fructû tardiora, lineari-ligulata, acuta. *Spatha* subsexflora polyphylla, foliolis inæqualibus linearibus subulatis erectis membranaceis. *Flores* unciales, *pedunculis* inequalibus teretibus gracilibus. *Corolla* coccinea: *tubus* attenuatus in *faucem* cylindricam ampliatus; *laciniæ limbi* oblongæ, lineatæ, exteriores parvo acumine. *Corona* cyathiformis, dentato—6-fida dentibus acutis. *Stamina* ad intervalla dentium coronæ. *Capsula* triloba, ovata. *Ruiz & Pavon.*

Patria: Peru; in collibus ad Tarmæ oppidi tractus. Horto Parisino a Dombeyo allatum flores tulit.

27. *aurantiacum.* P. sub 5-florum; foliis lanceolato-lineari-

bus, scapo tereti, floribus nutantibus, laciniis oblongis, acutis, patulis, coronæ sinubus repandis. *Kunth nov. gen. et spec. nov. orb.* 1. 223.

Scapus erectus, subpedalis. *Spatha* 3—4-valvis, arida, reflexa. *Flores* pedunculati, nutantes, 14—15 lineas longi. *Pedunculi* unciales v. sesquiunciales. *Corolla* infundibuliformis, clavata, aurantiaca; *tubo* cylindrico supernè dilatato, *laciniis limbi* oblongis, acutis, subæqualibus. *Stamina* limbo breviora; *filamenta* subulata infernè membranacea connata: *antheræ* oblongæ, incumbentes, *polline* saffraneo. *Germen* oblongum, 3-quetrum. *Stylus* corollam superans: *stigma* simplex, subcapitatum. *Capsula* ovata, 3-gona, polysperma; *semina* minuta. Pancratio *croceo* Redoutæi proximum differt structurâ coronæ si ea ritè depicta. *Kunth. Patria: Quito; propè Chillo.*

28. *flavum.* P. multiflorum; staminibus corolla longioribus, tubo coarctato, laciniis limbi reflexis.

Bulbus subglobosus. *Scapus* subteres, sesquipedalis. *Folia* posteriora floribus, linearia, paulò breviora scapo, 3 lineas lata. *Spatha* 5—9-flora foliolis membranaceis sublanceolatis. *Flores* aurantiaci, *pedunculis* inæqualibus. *Tubus* luteus, basi inflatus, medio coarctatus. *Laciniæ limbi* flavæ, oblongæ, ad medium usque convolutæ, supernè divergentes, apice reflexæ; interiores latiores. *Corona* limbo brevior, tubulatus, luteus, ore 6-fido lobulis erectis. *Filamenta* lutea limbo paulò longiora: antheræ luteæ. *Germen* subglobosum, obtusè 3-gonum: *stylus* declinatus lutescens. *Capsula* nigra, ovata, triloba; *semina* atra, ovata, obliqua. *Ruiz & Pavon. flor. peruv.* 3. 54. *t.* 284.

Patria Peru, in collibus arenosis ad Lurin tractus, passìm propè Pachacama castellum.

29. *recurvatum.* P. 1—3-florum; foliis bifariis, ensiformibus; corolla cernua: corona 6-dentata, dentibus staminiferis.

Pancratium recurvatum. *Ruiz et Pavon fl. peruv.* 3. 54. *t.* 285. *fig. α. Persoon syn.* 1. 351.

Chihuanhuaita. *Peruvianis vernaculè.*

Bulbus oblongus extùs purpurascens. *Scapus* anceps solidus. *Folia* longitudine ferè scapi, ecarinata, lineato-nervosa, apice reflexa. *Spatha* oblongo-lanceolata, rubro-purpurea, 1-phylla, striata, convoluta. *Flores* longè pedunculati, sæpiùs 3. *Pedunculi* inæquales, teretes, supernè incrassati, purpurascentes, erecti. *Corolla* purpureo-lutescens; *tubus* recurvatus, tenuis, uncialis; *limbi laciniæ* oblongæ, acuminatæ, sesquiunciales. *Corona* brevis, ovato-cyathiformis, dentato-sexfida, radiis 6 purpureis cum totidem luteis staminibus continuis alternantibus picta. *Stamina* longitudine corollæ; alterna subbreviora; *antheræ* luteæ. *Stylus* exsertus. *Capsula* obovata cum acuminulo, 3-lobo-trigona: *semina* magna.

Patria: Peru; in præruptis præsertim ad Cantæ provinciæ tractus circa Obragillo vicum. R. et P.

30. *latifolium.* P. multiflorum; foliis plurifariis petiolatis lamina oblongo-lanceolata, floribus pendulo-cernuis, limbo connivente, corona 6-fida.

Pancratium latifolium. *Ruiz et Pavon flor. per.* 3. 54. *t.* 284. *Persoon synop.* 1. 351.

Bulbus subrotundus laminis apice imbricatis. *Scapus* pedalis et ultra, teres, lucidus, erectus. *Folia* pedalia, latitudine 2—3-unciali, acuta, suprà striata nitida, subtùs nervosa. *Petioli* teretes 1—2-unciales. *Spatha* multivalvis, valvis sublanceolatis acutis aridis deflexis. *Flores* 6—7 v. plures. *Tubus* brevis: *laciniæ limbi* oblongo-lanceolatæ acumine minimo, conniventes, luteo-rubræ, apice virides. *Corona* lutea basi viridis. *Filamenta* subulata, dentibus coronæ alternantia, exserta flore: *antheræ* oblongæ, incumbentes. *Germen* obtusè 3-gonum: *stylus* filiformis longior staminibus: *stigma* parvum obsoletè 3-gonum. *Capsula* conica, trigona: *semina* plura, oblongo-subrotunda.

Patria: Peru; Andium umbrosis et humidis nemoribus, ad Vitoc arcis provinciæ Tarmæ vici tractus et colles. Ruiz et Pavon l. c.

31. *viridiflorum.* P. 4—5-florum; coronâ æquante limbum; staminibus exsertis.

P. viridiflorum. *Ruiz et Pavon flor. peruv.* 3. 55; *absque icone.* *Persoon syn.* 1. 351.

Bulbus oblongo-cylindricus, sesqui-palmaris. *Scapus* erectus, orgyalis! teres, lævis. *Folia* longa, plana, ensiformia, erecto-divergentia. *Spatha* valvis membranaceis albidis, acutis, sublanceolatis, deciduis, totidem ac floribus. *Flores* omnino smaragdini coloris! magni, perpulchri. *Limbi laciniæ* patentes, acuminatæ. *Ruiz et Pavon.*

Patria: Peru; in nemoribus passim in Huassahuassi et Palca versuris et locis petrosis.

32. *variegatum.* P. 4-florum; floribus longissimis, corona brevissima denticulis 6 viridibus furcatis reflexis. *R. et P.*

Pancratium variegatum. *Ruiz et Pavon flor. peruv.* 3. 55; *absque icone.* *Persoon synops.* 1. 351.

Flor del clarin. *Vulgò, ob figuram floris.*

Bulbus subrotundus. *Scapus* centralis, compresso-anceps, levitèr striatus, nitidus, foliis longior, solidus. *Folia* ensiformia, plana, venosa, striata, glabra, nitida, a medio ad apicem reflexa. *Spatha* compresso-anceps, 8-valvis, valvis ovato-lanceolatis, striatis, nervosis, deciduis; *exterioribus* 2 marginibus introflexis; *interioribus* gradatìm minoribus, carinatis. *Pedunculi* breves trigoni, in flore recurvati, in fructû erecti. *Flores* spithamæi, ex luteo roseo albo viridique colore variegati, cernui. *Limbi laciniæ* erecto-patulæ, luteæ, marginibus roseis, apicibus extùs viridibus intùs albidis, ovatæ, acuminatæ, subcarinatæ, exteriores latiores acuminibus longioribus retroflexis. *Corona* tubulosa, limbo duplo brevior. *Filamenta* subulata, erecta, stylo breviora: *antheræ* oblongolineares in coronulam conniventes. *Germen* oblongum, 3-gonum. *Stylus* longitudine corollæ: *stigma* capitatum integrum apice obsoletè apertum. *Capsula* oblonga, trigono-triloba; *semina* nigra. *Ruiz et Pavon.*

Patria: Peru; Limæ hortis. Horto botanico Matriti colitur flos iste speciosissimus.

33. *incarnatum.* P. subquadriflorum; scapo foliis linearibus duplo longiore, ancipite; laciniis ovato-ellipticis: coronæ sinubus bidentatis. *Kunth nov. gen. et spec. nov. orb.* 1. 223.

Folia supernè angustata, obtusa, reticulata, subsesquipedalia, unciam lata. *Spatha* lanceolata. *Flores* brevissimè pedunculati, subquinquunciales, singuli spathellati. *Corolla* tubo cylindrico supernè paulò dilatato, subquadriuncialis: *limbi laciniis* patulis 3 interioribus 3 exteriores subæquantibus, ovato-ellipticis, obtusiusculis, incarnatis, medio maculâ viridi notatis, subuncialibus. *Stamina* erecta, breviora limbo. *Corona* campanulata, brevissima, 12-dentata, inter dentes staminifera. *Antheræ* lineari-oblongæ, incumbentes. *Germen* oblongum, 3-quetrum. *Stylus* subæquans stamina: *stigma* obtusum, 3-gonum. *Capsula* oblonga, 3-gona, polysperma. *Kunth l. c.*

Patria: Quito; in ripâ fluminis Machangara.

Species inquirendæ.

maximum. P. uniflorum; petalis patentibus; nectario pedali. *Forskål fl. ægypt. arab.* 72.

Caulis v. *scapus* teres glaber. *Nectarium floris* enorme, cum tubo pedali. *Petala* alba, staminibus longiora, acuta, patula, at non reflexa ut in P. *zeylanico. Folia* non vidi. Legit illam et mihi attulit unicam Dn. Niebuhr, socius itineris, propè Taæs. *Id. loc. cit.*

humile. P. subbiflorum; foliis subulatis tenuissimis, intùs planis. *Cavan. ic.* 3. 4. *t.* 207. *fig.* 2.

Pancratium humile. *Willd. sp. pl.* 2. 42.

Bulbus ovatus, integumentis fuscis. *Scapus* filiformis, tenuissimus, 3-uncialis, florens absque foliis. *Spatha* oblonga, acuta, cucullata. *Pedunculi* inæquales, capillares. *Corolla* lutea, profundissimè partita, laciniis ovato-oblongis, apice subrevolutis, obtusis. In hujus centro *corpusculum* luteum, brevissimum, infundibuliforme ore 12-fido staminifero. *Filamenta* capillaria, corollæ sub-

æquilonga : *antheræ* subsagittato-oblongæ, incumbentes. *Germen* turbinatum, obtusè 3-gonum : *stylus* filiformis, staminibus longior: *stigma* obtusum.

Patria : Hispania ; in ditione Hispalensi.

NOTE.

Since the publication of the paper on AMARYLLIS in the Second Volume, No. IV. and Article XIII. of this Journal, a new species of that genus has been recorded ; an account of which will be found in the Third Volume of the Botanical Register, No. 199, under the title AMARYLLIS PSITTACINA.

ART. IV. *Description of the Vallies of Cucuta in South America.—By M.* PALACIO FAXAR.

THE provinces of New Granada, north of Santa Fè de Bogota, are Tunja, Socorro, and Pamplona, situate on a ridge of mountains, which crosses part of New Granada and Venezuela. The streams falling from these mountains east and south, form the rivers Meta, Apure, Portuguesa, and others, which enter into the Oronoco ; those which descend westward, as far as el Paramo de Cacota, in the province of Pamplona, give rise to the rivers Sogamoso, Suarez, Opon, Carare, and many others which fall into the Magdalena. The streams which fall north of el Paramo de Cacota, as far as el Paramo de las Rosas, in the province of Caraccas, form the rivers Sulia, Escalante, Santarosa, Motatan, and more than forty others, which fall into the lake of Maracaybo. This lake is ninety miles in extent from north to south, and sixty from east to west, and is in the form of a horse shoe. The eastern and northern banks of the lake are parched and barren, but on the western and southern sides the land is beautifully fertile. South of the lake, there is a thick and luxuriant forest, in many parts forty miles broad, watered by innumer-

able torrents and rivers. The plantations of cocoa trees, sugar canes, Indian corn, Jatropha manioc, banana trees, and various sorts of peas, scarcely require the hand of man to cultivate them, for they produce almost spontaneously the most delicious fruits in abundance. But those causes which give rise to fertility in the earth, are destructive to the constitution of man, whose system appears always enervated, his skin of a livid hue, and his eyes sunk and hollow, nor are the charms of youth ever seen on his cheeks. The climate, and indolence, here shorten the life of man, who having dragged on a spiritless existence for thirty or forty years, generally resigns his being without one sigh of regret. Travellers, in passing through these unhealthy regions, are often attacked by intermittent fevers, of so malignant a nature, that the third paroxysm is frequently fatal.

The province of Tunja contains a population of two hundred thousand persons, scattered through the valley of Sogamoso, the plain of Cerinza, the districts of Suata and Sativa, and the banks of the river Suarez or Capitanajo. Santarosa is one of the most beautiful towns of the province; but Tunja is the capital, and still displays the pride of its founder, in the heavy magnificence of its buildings. The population of Socorro amounts to one hundred and thirty thousand persons, who inhabit the districts of Valez, Sangil, Ocaña, and Socorro. The population increases with considerable rapidity in this province, whose inhabitants are distinguished in New Granada for their industry and independent spirit. The province of Pamplona contains a hundred thousand inhabitants; and its principal districts are Pamplona, Giron, and Cucuta. The capital of the province bears the same name, and is situate in a narrow valley; a small river runs through it, and it is surrounded by high mountains, and adorned by many good buildings. A nunnery, several monasteries, a Gothic church, the municipal hall, and the buildings destined as store-houses for the articles monopolized by the government, are the most conspicuous. Giron is famed for the superiority of the gold, which is carried down the streams which cross the district, but above all by that collected in the river Sanjuangiron.

It is likewise celebrated for female beauty, and rendered famous by the discoveries of Don Eloy Valenzuela, curate of Bucaramanga. This enlightened clergyman has made known a method of preserving meat fresh for many months by the use of molasses. He has discovered a new species of potatoe, and is the cultivator of a grass superior to many of the artificial pasturages. He has employed many years in collecting plants, a description of which he intends publishing under the name of Flora de Bucaramanga.

Cucuta, or the vallies of Cucuta, are situate north of Pamplona, in a country divided into different vallies, by hills of no considerable height, forming a circle about ninety miles in circumference. The principal towns are built on the banks of the rivers Sulia, Pamplona, and Tachica; and are Sancayetano, Sanjose, Sanfaustino, Rosario, Sanantonio; there is likewise the village of Cucuta. The population does not exceed thirty thousand persons. On the south and east of these vallies is the Cordilliera, but its elevation in this part is not considerable. The luxuriant forest which borders the Sulia forms the northern and western boundary of these vallies. The earth is sandy, in many parts of a red colour; there are nevertheless considerable tracts covered with a thick stratum of vegetable earth. In the road from Sanantonio to Layeguera, great quantities of sulphate of magnesia are found in the dry season. The roads are bad, the hills without verdure, the plants of the genus mimosa, agave, and cactus, abundant. The wind blows from the east in the morning, and is then cool and refreshing; it changes to the west in the middle of the day, and, in some months, to the north in the afternoon. In the months of June, July, August, and September, the heat is intense; frequently for many hours together there exists a perfect calm. I have often seen Fahrenheit's thermometer at 96° in the night. In these months the rain is frequent and copious; and in general accompanied with thunder and lightning. The torrents which come down at that season from the mountains, carry every thing before them, and the rivers swell considerably. But from December

till April, scenes like these entirely cease; the weather is constantly fine, and the temperature mild and pleasant.

The vallies are wonderfully fertile; most of the trees bear fruit twice in the year, in December and June. The coffee tree is cultivated in the mountainous parts; and in the vallies the sugar cane, indigo, and cacao tree flourish luxuriantly. It is a fact ascertained by the planters that the Otaheite sugar cane contains much more crystallizable matter than the common sugar cane. The quality of the cacao grown here is excellent; it ranks immediately after that of Soconusco and Caraccas. The produce of these plantations is sent to Maracaybo, and European goods are received in exchange. Intercourse with Maracaybo is carried on by the river Sulia; the principal ports in the river are Limonto, Cachos, Buenavista, and Sanfaustino. The only vessels they have are boats, which they call *bongos* and *lanchas;* the lanchas are built in the arsenal of Maracaybo; but the bongos are constructed on the banks of the Sulia; they are often made out of one single tree, yet they are generally six feet broad and thirty long. Two-thirds of the bongos are covered with palm tree leaves, forming a sort of roof, which protects the cargo from rain; sufficient space is left in the extremities of the bongos for the necessary manœuvres of the boatmen. The person entrusted with the care of the cargo and the command of the boat, is called the patron, and he always sits on the top of the covering, that he may be able to observe any obstacles in the navigation, and give the necessary orders. The Sulia being both broad and deep, and running through a level country, the navigation, in descending the river, is safe both by day and night; but some danger attends the carrying the boats up the river; it is requisite to keep them very close to the banks, to enable the men to use their *palancas* or poles. Before crossing the lake of Maracaybo, the boats are obliged to touch at the custom house, which is in the island of Damar, where they are examined, to prevent smuggling; this island is formed by the lake and a branch of the Sulia. Sails are used in crossing the lake until they reach the port of Maracaybo.

Cattle is neither abundant in the vallies, nor in the neighbouring provinces; but the inhabitants receive supplies from the plains of Barinas and Casanare. The roads being bad, the cattle untamed, and having to pass a distance of more than two-hundred miles through a rugged country, a third part generally perishes in the journey. The owners of cattle, who speculate in bringing them to these distant markets, take previous care to accustom their herds to pass the night near the Hato, or the drover's house, in a close place, which they call *majada*. This is no easy task; but they succeed at length, by the exertions of the drovers, *vaqueros*, who take great pains to lead the cattle to pasture in the morning, and to the *majada* in the afternoon. Thus prepared, a superintendant is elected for the journey. The drovers travel on horseback; a walk of even three miles would be to them insupportable. A considerable number of horses is obliged therefore to follow for the use of the *vaqueros*. The only provisions which they take in these journeys are, bread made from *cassavi*, or Jatropha manioc, raw sugar, and cheese. Guitars form always part of their equipage. The time being arrived for their long journey to commence, the owners of the cattle, and the friends of the drovers, assemble, and accompany the travellers in their first day's march, which always proves the most troublesome of any; for as soon as the animals miss the pasture and place they have been accustomed to, they become alarmed, and express their alarm by returning back, running up and down, roaring and butting. Sometimes it happens that all the drovers' skill cannot bring them into subjection, and then the whole herd escapes to the plains; but more frequently the alarm subsides by degrees, and the night is passed in quietness. On the second and even the third day, similar scenes often recur; at length, exhausted and subdued by fatigue, they proceed with sullen slowness. Many die in the way, others, when nearly overpowered by fatigue, are killed, and the flesh salted down; and the remnant generally arrives at the place of destination weak and lean. These journeys last about twenty days; they begin their march at eight or nine in the morning, and commence their rest at four in the after-

noon. Each night after supper, the superintendant having selected those who are to watch the herds in the night, the others assemble in a circle, each one holding his guitar. They sing alternately; their exploits in wrestling, in bull-fighting, in cudgeling, riding, or their amorous adventures, form the subjects of their songs. Frequently two of them sing a pastoral dialogue, sometimes of their own composition, but more frequently of that of their most famous bards, as Salinas, Ignatio, and others. The road passing through a country which is almost desert, there being very few dwellings in it, and the heat of the climate being very great, the *vaqueros* travel with no other dress except a pair of trowsers. But when they approach Cucuta, they then resume their own peculiar attire, which consists of a long shirt, made of calico or linen, striped with blue, red, or yellow: the trowsers are made of the same materials; a straw flat hat covers their heads, and a red handkerchief is tied round their necks, and under their left arm. They carry two other handkerchiefs in the pockets of their trowsers, with the corners hanging out. Thus arrayed, they enter Cucuta to sell their cattle.

The traveller who approaches Cucuta by the road of Pamplona, or that of Lagrita, experiences a very oppressive feeling as soon as he enters the first valley. It appears as if he were shut up in an oven; the heat overpowers him almost to suffocation. This oppressive feeling of heat, however, subsides as soon as perspiration takes place.

As the constitution and mind of man are ever influenced by the climate in which he lives, the inhabitants of the elevated, foggy, and cold towns of Pamplona, Lagrita, and the surrounding villages, are fond of retirement, peaceful, silent, thoughtful—yet smiles are ever on their lips. Vegetation, though uninterrupted, is never luxuriant. Insects and reptiles here are few, and harmless. The aspect of the enormous, yet varied masses which crown the Cordilliera, elevates, unconsciously, the minds of the inhabitants to the contemplation of the wonderful structure of the universe;—the whole face of the country wears an appearance of grandeur, yet at the same time, of calmness and innocence. A stranger

visiting these regions, and contemplating these examples of tranquil happiness, might be naturally led to expect in their environs, similar features of nature, and inhabitants with equal simplicity of mind and manners. But how great must be his disappointment, when passing over but a few leagues, he finds himself, as it were, in an opposite world! An unclouded sky, an atmosphere perfectly serene, vegetation flourishing, a country abundantly peopled. But from the smallest insect to the lords of the creation, all are in motion, bustle, and continual strife: aiming at mutual destruction.

The population of Cucuta is composed of Spaniards, Creoles, Indians, slaves, and men of colour. The Spaniards and Creoles are but few in number, but they are the only planters. They appoint their majordomos to preside over their plantations, and pass their own time in pleasure and idleness.

The dress of the females is the same as in Spain, in the summer; that of the gentlemen consists of pantaloons, waistcoat, and great coat, all of linen or calico, and a straw hat, in form like European hats. They rise early, go constantly to church, return home at nine, when breakfast *à la fourchette* is served, in which chocolate is always introduced. Visiting occupies the time till twelve o'clock, when they return home to dinner. The siesta follows the dinner: and when they rise from their couches, a repast is served, consisting of preserves and chocolate. The gentlemen ride on horseback from five till six; at seven visiting re-commences. In the dry season, it is always in the street, close to the doors of the houses, that company is entertained. At nine they retire to supper, when the evening closes with familiar conversation, and musick, vocal and instrumental; the instruments are the harp and guitar. Dancing is with them a favourite amusement; invitations for dances are sent by a female servant, richly attired. Their balls are opened with minuets; country dances and waltzes follow; but the fandango, bolero, and guaracha, are always introduced. Violins, harps, guitars, and tambourins compose their band.

The festival of the patron saint of each town, is celebrated with public processions, bull fights, theatrical representa-

tions, cock-fights and *cañas; cañas* are the individual fighting of two corps, supposed to be Moors and Spaniards. There are besides, two other corps of supposed angels and demons, who assist and protect the combatants in case of necessity. They are all on horseback, wearing appropriate dresses, and are posted in the four angles of the principal square, which is closed with barriers. The Spanish corps challenges the Moors; single combat is proposed, which being accepted, the heralds proclaim the conditions. A Spaniard rides into the middle of the square, a Moor comes to face him; the combat commences by each firing a brace of pistols; they then take up their swords, and the fighting continues till their mutual skill is acknowledged by the spectators. They then alight from their horses, and poniards decide the fate of the combat. An angel and a demon, who during the struggle, have watched the movements on each side, run forward to afford protection to the combatants, and succeed in separating them. Other warriors then take the field, when many similar combats are fought. With respect to the cock-fighting—the people of Sanjose, and of el Rosario, which are the principal towns, some months previous to the festivals, challenge each other to a cock-fight, and propose the conditions. Some of these battles are fought between cocks unarmed, others between cocks armed with knives; sometimes the cocks are previously seen; at other times a party presents a cock who is to fight its opponent, whether the cock be taller or stronger. The odds seldom exceed two hundred dollars, and any disputes that may occur, are settled by arbitration. The theatrical representations are made in temporary buildings erected for the occasion, in the principal square; these buildings merely consist of an elevated floor, divided into two parts by a curtain, made of cloth of varied colours, which is never changed. The performers are all men, and the plays performed are those of Calderon, Lope de Vega, &c. The principal character is always that of a buffoon. The spectators are frequently roaring with laughter, at the ludicrous gestures of the buffoon, at the moment when probably the hero of the piece is stabbing himself. When the most necessary arts of life have not yet found

their way into Spanish America, how can it be expected that a good play should be well performed in the provinces? The theatres of Mexico and Lima, can scarcely be placed in competition with even the provincial theatres in Spain; and those of Caraccas, Buenos Ayres, Chili, Santa Fè, and Goatemala, sink so far below, that they can in no way bear a comparison.

The native Indians of Cucuta, are a degraded, poor, neglected, almost forgotten, race of beings, which indeed is the case with the whole race of Indians. Yet it may not be too late to raise them to the dignity of man, were some means taken to improve their minds. But as the isolated state in which they live, is the result of the present legislation, the amelioration of their condition must still depend on the government. New laws, or perhaps the simple abolition of the laws made for this unfortunate people, might produce for them a favourable change. They ought to be considered as subjects of the State, participating in the rights of other citizens—not as a nation of children, whose intercourse with men might destroy their innocence. These timid people generally, and firmly believe, that every thing proposed to them by the Spaniards, tends to their destruction; thence it arises that distrust and hypocrisy become prominent features in their character. Some, animated by a benevolent zeal, have endeavoured to remove this error, but hitherto their efforts have been fruitless; for this people oppose even an act intended to favour them, with distrust, and thus destroy their own good. Many examples might be given to prove this assertion; I will select one which I witnessed myself. The late bishop of Merida de Maracaybo, Don Santiago Hernandez Milanes, a plain, unaffected, compassionate, and learned prelate, in his visit through his bishopric in 1806, chose from among the Indians of Mucuchies, two young men, who appeared well disposed to receive instruction. He gave them apartments in his palace, and entertained them most kindly; they were admitted to the public lectures in the college of Merida, where the professors watched particularly over their improvement. All was vain; they seized the first opportu-

nity to make their escape, and returned home. Their parents, as well as the curate of Mucuchies, blamed their conduct, and by order of the bishop, they were again brought to his palace, and every attention towards them re-doubled. Again they made their escape, and were again brought back. Every effort was made to keep them in Merida—all proved vain ; a third time they escaped.

The number of slaves is not considerable in Cucuta, and these are kept in subjection by removing them as far as possible from all intercourse with free-men. To effect this, chapels are built in the principal plantations, where mass is said on all festivals.

The men of colour form the most numerous part of the population. They are robust, tall, strong, active, and enterprising. Whatever arts are known in Cucuta, are practised by them. This race is numerous in all Spanish America ; and it is much to be feared that they will at length obtain the entire superiority in these regions. From Tuesday till Saturday morning, the Mulatoes of Cucuta, are employed in working in the plantations, or engaged in their shops. On Saturday afternoon, all work is suspended, and they visit the towns. Until Monday morning, they indulge in uninterrupted scenes of riot and debauchery, in which occasionally even some lives are lost. The public houses are full; in these meetings there is little conversation ; some play at cards, others sing; all drink, and all are noisy. Rum, and a kind of fermented liquor, called Guarapa, resembling mead, but made from sugar instead of honey, and pine-apple infused in water, are their favourite drinks. They eat with much delight, a sort of pudding, *hallaca*, made of meat, lard, and onions, hashed together, and covered with a thick paste made of Indian corn ; this is wrapped in the leaves of the banana tree, and thus boiled.

The houses are all built with spacious courts in front. When a dance is given to the common people, it is always in these courts, where seats are placed, and musicians, who play on the guitar, tres, and maraca. As soon as the people hear the sound of these instruments, they hasten to the spot, and the dancing begins. No invitations are necessary, for such

balls; and the moon is frequently the only torch which brightens the scene. The tres, or three, is a small instrument with three strings, which is tuned by fifths, and an octave higher than the guitar, it is played with a small piece of horn. The maraca is made of a *totuma*, which is round, and in which two holes are made opposite to each other, by which the totuma is cleansed from the white substance which covers its seeds. Small globular seeds of other plants are then introduced into the cavity of the totuma, and a polished short stick of hard wood is fitted to the holes, by which this fruit, now formed into an instrument, is held. This is the most monotonous, and noisy musical invention that was ever made.

The dances practised here are the fandango, folias, and galeron. The galeron is danced by only two persons at a time; the man always keeps in the middle of the circle, constantly turning round; his partner dances round the whole circle, always looking at him; having done this once or twice she yields her place to the next female; but the man always continues, till another presents himself in the circle, giving a signal of his willingness to dance, by making his bow. The air of this dance is most monotonous.

Among the different folias, there is one called *capuchina*, which I will describe, as it may give some idea of the character of the inhabitants of this torrid climate. The air is composed of three parts; the first two are expressed by singing, to which the dancers must pay particular attention. The dancers place themselves in a circle, the female keeping always on the left of her partner. The musicians begin by singing a couplet, during which time the man foots it with his partner, then with the female next to her. This being finished, the musicians sing alternately a dialogue, according to the meaning of which the dance is carried on.

1. Give me your fair hand.

2. I consent.

1. Go backwards one step, and hold me in your arms.

2. With pleasure.

1. Approach a little and kiss me, that I may know the sweetness of your mouth.

2. With all my heart.

This singing dialogue being ended, the instruments play the third part of the air, when the dancers dance round each other, describing the figure of an S, till each returns to his own place, or rather advances one step in the dance. This continues till the men have danced with every female of the company.

London, the 2nd of June, 1817.

M. PALACIO-FAXAR.

Art. V. *On a new Method of constructing Chimnies.*

No contrivances are of more importance than those which may be classed under the head of Furnaces; without them, we should enjoy few of the necessaries and none of the comforts or luxuries of life; they comprise all kinds of fires, from those employed for mere culinary purposes, to those requisite for smelting metals, working steam engines, &c. As to the last, though great have been the improvements in the engines themselves, the furnaces remain nearly in the same state as Mr. Watt found them, any practical improvement in their construction, must therefore be worthy of attention.

The best test of the construction of a steam engine furnace, will be in the greatest quantity of water evaporated under a given pressure with the least quantity of fuel; from the experiments of Mr. Dalton, Count Rumford, Dr. Black, and Mr. Watt, it appears that the heat generated in the combustion of 1lb. of coal should be sufficient to reduce from 6 to 8lbs. of boiling hot water to steam, and if more than this weight is used, there is a proportionate quantity of heat lost.

To ascertain therefore, experimentally, the effect of the construction of the chimnies now under consideration, a steam engine boiler, of the form most generally used, was seated and worked in the usual manner; there was a very quick consumption of the fuel; the heat of the chimney averaged 440 of Fahrenheit; and 1lb. of Hartley's Newcastle coal, reduced

5lb. 8oz. of boiling hot-water to steam, under a pressure of 4 inches of mercury; and it is here necessary to state, that the heat of the flues seldom boiled away in cooling more than two gallons of water for every bushel of coals used in the day. But when the same boiler was seated, according to the annexed drawing and description, for which a patent has been obtained, the heat of the chimney was reduced to 250°, and 1lb. of the same coal reduced 7lb. 12oz. of boiling hot water to steam, under a pressure of four inches of mercury; thus approximating to the greatest possible quantity that can be practically effected, and making a saving in fuel of 30 per cent. over the common methods; besides which, the heat that was retained in the flues evaporated from 6 to 10 gallons of water, in cooling, for each bushel of coals that had been used.

In the common method, the boiler soon cooled; but in the patent way, it retained heat much longer. In the common way, the usual thick dense smoke issued from the top of the chimney: in the patent way, the smoke was three parts consumed, and the little that was discharged rendered of a light yellow brown. If these are advantages worthy of attention, an inspection of the plan will shew them to be the natural consequences of the improved arrangement.

First. By not allowing the cold air to pass between the fire and the bottom of the boiler, when the furnace door is open, the heat of the fire is not driven down between the bars, so as to melt them, nor the boiler cooled, thus making a considerable saving in wear and tear, as nothing is more destructive than sudden changes of temperature, and the action of air and moisture, on the hot surfaces of metallic bodies; for the draft of cold air that usually passes between the fire and the boiler, on opening the furnace door, is far more powerful than that which ever enters the ash-pit.

Secondly. As the intensity of the heat, is in proportion to the consumption of oxygen gas, so that is generally increased when the wind blows favourably to the ash-pit, and is as much diminished when the reverse happens; but by supplying the furnace with air from the shaft Z, all the effects that naturally

arise from the variations of the velocities and courses of the wind, and its action on the fire and chimney are completely counteracted. In all small fires, and in many large furnaces, these united effects are found very considerable. The shaft, chimney, flue, or tunnel for the regular passage of permanently elastic bodies, should increase in dimensions from the orifice at which it is either to be received or discharged; thus, if A was contracted at the top, the elastic smoke would be confined in the body of the chimney, and operate against the draft of the fire at B, and if Z was no larger than the aperture X, an adequate supply of air would not be received.

Thirdly. By causing the smoke to descend until it comes again into contact with the heat of the fire, through the small aperture at the bottom of D, two objects are attained. One, that of igniting and consuming the inflammable vapours distilled from the coal, and not burnt in the furnace. The other, by retaining in the furnace all the heat above the aperture B.

Fourthly. This construction of the chimnies alone will scarcely be sufficient in furnaces consuming a chaldron of coals per day, without attention is paid to the constantly supplying it, for which the contrivance shewn in the plate becomes necessary, and can be applied to furnaces where the descending flue could not, as in salt pans and all shallow boilers.

From particular attention paid to the various trials of which the above is the result, it was found that no advantage was gained or lost in the evaporation of water under the various changes of the barometer, for when standing high, it increased the briskness of the fire as much as it pressed on the water; and when low, the contrary.

There was also more water constantly evaporated, when under a pressure of four or six inches of mercury, than when in the open air, arising from the increased heat being above the increased pressure; and, Lastly, That when the furnace and boiler had attained the maximum of temperature, no proportionate effect was produced by even doubling the quantity of fuel.

Reference to the Plate.

Fig. 1, Section and elevation of the chimnies, and the method of supplying the fire with fuel.

Fig. 2. Plan of the apparatus.

Fig. 3. Section of a part on a larger scale.

Fig. 4. Perspective of coal box. Fig. 5. Plan of ditto.

A. The smoke discharging chimney.

B. The only aperture into it.

C. The descending flue.

D. The back of the fire, generally of Welsh lumps, but this may be made a part of the boiler, and taken away at pleasure; at the bottom of this back is left a small aperture, not two inches deep, and the width of the grate through which a strong draft, but not the smoke, passes, being closed with the red embers.

E. A flat bed plate the width of the fire bars and placed above.

F. The door as usual for making and raking the fire.

G. A spring made of steel or wood attached to a stationary block M, at one part, and fastened to K at L, in the other.

H. The brick or frame work to support E.

K. A sliding rail with shelf at top, the length of which, if one or more, should be equal to the width of the fire bars.

N. The perforated end of the coal box.

O. The starlings to prevent the holes being choked up.

P. The coal box, the width equal to K, one end resting on

Q. A notched snail wheel; this wheel may be placed above the coal box, or in any other more convenient part, so, that by means of levers and chains, or other connections, similar motions be given to the box and springs.

R. A filling up piece of cast iron, with a branch or shoe at bottom, to take the small coals off the shelf K.

S to T. Enclosures on all sides, leaving only sufficient space for the apparatus to work, the whole of which being in constant motion, and screened from the fire, by the constantly falling crude fuel, is not subject to being burnt away.

U. A double lever working on a pivot, having

V. A bearing piece working on the wheel Q.

W. The connecting rods or chains from the lever U to the sliding shelf K.

Z. An air shaft, for receiving a supply of external air, from every quarter from which the wind may blow.

Y. Any convenient height at which the same may be terminated above the roof or adjacent buildings.

I. The connecting branch carried to X.

X. Apertures for supplying the fire with air, and regulated by valves or dampers, the size of which, when open, are equal to B. Nothing is found more effectual to damp the fire than preventing a supply of air.

5. Brick work placed in the mouth of the flue to preserve the boiler and inflame the smoke.

22. An aperture for the admission of cold air if requisite for the final combustion of the smoke.

23. A door for taking out the ashes or cinders from the bottom of A.

24. The damper to regulate the aperture B; this and X should be regulated at the same time to the same size.

From an inspection of the above application to the boiler of a steam engine, it will be seen, that the smoke comes to, and rises at the front, returns along the sides, and descends behind, and that a current of cold air cannot pass between the fire and the boiler, even if the door should be left open, while the brick-work at 5, becomes of such a heat, as to inflame the smoke, and which is finally consumed as it descends and mixes with the heat of the fire coming from the aperture at the bottom of D, consequently, the heat is retained in the fire and furnace above the aperture B.

The regular and constant supply of the fuel, will be as follows. On the wheel Q being moved round by hand, engine, or otherways, the end of P becomes elevated, until at the next notch, it suddenly falls, and throws a *small* quantity of fuel upon the top of the shelf K, the wheel continuing to move round, forces the lever U back, and with it, the sliding rail and shelf K, which compresses the spring G, and the coals or fuel falls upon the bed plate E, which soon becomes heated from the construction of the furnace; and when the

notch of the wheel arrives at V, the springs are suddenly greased, and the fuel is thrown upon the fire in a flaming state, and that *without ever opening the door*, so that by varying the velocity of the motion, and the power of the springs, any quantity of coals may be equally distributed over the largest fire, the smoke thus entirely consumed, and a considerable saving of fuel effected; while the fire may be urged to any extent by the operation of the air valves at X. Dr. Black, in his lectures on fossil coal, has fully pointed out the necessity of better contrived furnaces, and of supplying them more constantly, but with less fuel, at once, to whose able remarks, I am indebted for inventing the machine before described.

The construction of this furnace is equally applicable to all kinds of large fires and furnaces, for whatever purposes they may be intended, as for steam engines, breweries, distilleries, rectifiers, soap boilers, tallow melters, sugar bakers, salt refiners, dye houses, glass houses, potteries, air furnaces, and all others, which consume much fuel; and the construction of the chimnies alone, are equally applicable to smaller fires, as, bakers' ovens, japanners' stoves, coakels, air and hot house stoves, and the grates of private and public buildings.

The last application of this invention having been fully tried, and highly approved, by all who have entered into the merits of it, and as it forms a very leading feature in our domestic health and comfort, it may possibly be worthy of a separate paper, particularly when it is stated, that the fire grates and chimnies being so altered, the largest room can be warmed from 55 to 80 degrees, *without smoke, dust, or coal-drafts*, by the radiant heat of an open fire, and with a considerable saving in fuel.

I remain, Sir,

your very obliged servant,

Jos. Gregson.

Charles-street, Grosvenor-square,
May 28, 1817.

ART. VI. *An Account of some Experiments on the Escape of Gases through Capillary Tubes. By Mr.* Faraday, *Assistant in the Laboratory of the Royal Institution.*

As the mobility of a body, or the ease with which its particles move among themselves, depends entirely upon its physical properties, little delay would arise in the mind, on a consideration of the probable comparative mobilities of the different gases. These bodies being nearly similar in all these physical properties, except specific gravity, which can interfere with internal motions generated in them, would be supposed to have those motions retarded in proportion as this latter character increased: but as this supposition has not been distinctly verified, the following experiments, though possessed of no peculiar claim to attention, may deserve to be recorded.

The apparatus was a copper of the capacity of 100 cubic inches, nearly, to which a condensing gauge was attached. Four atmospheres of the gas to be tried, were thrown into it, and then a fine thermometer tube, 20 inches in length, was fixed on by adjusting pieces: the gas was suffered to escape until reduced to an atmosphere and a quarter, and the time noticed by a seconds pendulum. In this way,

Carbonic acid gas required	156.5 minutes to escape.
Olefiant gas	135.5
Carbonic acid	133
Common acid	128
Coal gas	100
Hydrogen	57

These experiments tend to shew, that the mobility of the gases tried, decrease as their specific gravity increases, and they are corroborated by others made with vanes. A wheel, having small planes attached to it, as radii perpendicular to the plane of motion, was made to rotate by a constant force in atmospheres of different gases, and the times which the motion continued, after the force was removed, diminished as the specific gravity increased; as for instance, in

Carbonic acid, it continued	6 seconds.
Common air	8
Coal gas	10
Hydrogen gas	17

There is, therefore, every reason to believe, that the actual relative mobilities of the gases, are inversely as their specific gravities.

These experiments have been carried much farther, in consequence of some peculiar results obtained at low pressures; but as I have not been able to satisfy myself respecting the causes, and have probably taken a wrong view of the phenomena, I shall refrain from detailing them, and merely observe, that there is no apparent connection between the passage of gases, through small tubes and their densities, at low pressures. Olefiant gas then passes as readily as hydrogen, and twice as rapidly as either carbonic oxide, or common air, and carbonic acid escapes far more readily than much lighter gases. Similar results are also obtained by diminishing the bore of the tube, and then even at considerable pressures, the effect produced by mobility alone, is interfered with by other causes, and different times are obtained. These anomalies depend, probably, upon some peculiar loss or compensation of forces in the tube, and offer interesting matter of discussion to mathematicians.

Art. VII. *Note respecting Elimination. By* Charles Babbage, *Esq. A. M. F. R. S.*

The following observations will frequently obviate the necessity of the tedious process of elimination, and when only a few of the roots are required, they point out a ready method of obtaining them. The class of equations to which they are applicable, comprehends the following

$$F\left\{x, y, z, v, \&c.\right\}=o, \ F\left\{y, z. v, \&c.\right\}=o, \ \&c.$$

Suppose it were required to find some of the values of x and y from the equations

$$F\left\{x,\ y,\right\}=o \text{ and } F\left\{y,\ x,\right\}=o$$

Since the first of these equations contains x exactly in the same manner as the second contains y, it does not appear from these two equations, that there is any reason why x should have a different value from y: we may therefore suppose it equal to y, and taking either of the two equations we have

$$F\left\{x,\ x\right\}=o$$

from which we may find several values of x and also of y, since by our supposition y is equal to x.

Ex. 1. Given the equations

$$x^2+ay=b \text{ and } y^2+ax=b$$

making $y=x$ we have

$$x^2+ax=b \text{ or } x=y=-\frac{a}{2}\pm\sqrt{b+\frac{a^2}{4}}$$

as a particular case take $x^2+4y=5$ and $y^2+4x=5$ this gives $x=y=-2\pm 3$, and it will be found on trial that $x=y=1$ or $x=y=-5$, satisfy the equations.

Ex. 2. As a second example, let us take the two equations $x^3-8x=2y^2$ and $y^3-8y=2x^2$, since these contain x and y similarly we have by supposing $y=x$ either $x=y=4$ or $x=y=-2$, either of which pair of values satisfy the equations.

In a similar manner it will be found that one solution of the equations

$$x^2+axy+by^2=cy,\ y^2+ayz+bz^2=cz \text{ and } z^2+azx+bx^2=cx$$

will be $x=y=z=\dfrac{c}{1+a+b}$.

The same principle may be extended to another class of equations comprehended under the form

$$F\left\{x, f(x,y)\right\}=o,\ F\left\{f(x,y),\ x\right\}=o$$

for if we substitute v for $f(x, y)$ we have $F(x, v)=o$ and $F(v, x)=o$, and since these equations contain x and v similarly we may suppose $v=x$, and hence

$$F(x,\ x)=o$$

from which we may determine x, and since $v = x$ we have $f(x, y) = x$ or $y = f^{1,-1}(x, x)$ which gives the values of y.

Ex. 3. Let $x^2 + ax\,(a' + b'x + c'y) = b$ and $(a' + b'x + c'y)^2 + ax\,(a' + b'x + c'y) = b$, be the given equations, since the first contains x and $a' + b'x + c'y$ in the same manner that the second contains $a' + b'x + c'y$ and x, we may therefore suppose $a' + b'x + c'y = x$ hence

$$x^2 + ax^2 = b \text{ and } x = \sqrt{\frac{b}{1+a}}$$

also from the equation $a + b'x + c'y = x$ we have

$$y = \frac{1-b'}{c'}\sqrt{\frac{b}{1+a}} - \frac{a'}{c'}$$

as a particular case take the equations

$$x^2 - 2x\,(y + 2x - 4) = -4$$
$$(y + 2x - 4)^2 - 2x\,(y + 2x - 4) = -4$$

the two pairs of values which satisfy this equation are

$$\left.\begin{matrix} x = 2 \\ y = 2 \end{matrix}\right\} \text{ and } \left.\begin{matrix} x = -2 \\ y = -6 \end{matrix}\right\}$$

By treating the equations

$$x^2 + 4\,(1 - y^2) = 5$$
$$(1 - y^2)^2 + 4\,x = 5$$

by the same method we should find

$$\left.\begin{matrix} x = 1 \\ y = 0 \end{matrix}\right\} \text{ and } \left.\begin{matrix} x = -5 \\ y = \sqrt{6} \end{matrix}\right\}$$

For another example take the equations

$$x^3 + 6x^2 - 7\frac{y}{x} = o \text{ and } \frac{y^3}{x^3} + 6\frac{y^2}{x^2} - 7x = o$$

in this case x and $\frac{y}{x}$ occur similarly, we may therefore suppose $\frac{y}{x} = x$ or $y = x^2$ this gives

$$\left.\begin{matrix} x = 1 \\ y = 1 \end{matrix}\right\} \text{ and } \left.\begin{matrix} x = -7 \\ y = 49 \end{matrix}\right\}$$

both which sets of values satisfy the equations.

It is obvious that similar reasoning may be applied to equations containing any number of variables.

Art. VIII. *Sketch of an Introductory Lecture to a Course of mineralogical and analytical Chemistry, delivered in the Royal Institution of Great Britain.—By* W. T. Brande, *Sec. R. S. Prof. Chem. R. I. &c.*

[At the request of many of those who attend the Lectures of the Royal Institution, an outline of the courses will occasionally be given in this Journal.]

In the various courses of Lectures which you have done me the honour of listening to from this place, it has ever been my aim to select those subjects for discussion in which usefulness is blended with interest, and there is no branch of science so rich in such topics as chemical philosophy; none, the advancement of which is more intimately connected with the progress of the arts of life. To attain the depths of any department of knowledge, to become versed in its principles, and to acquire the manual dexterity of the experimentalist, require a peculiar train of study, independent of oral communication or ocular demonstration; therefore have I always endeavoured rather to present you with general and comprehensive views, than with particular and minute surveys, considering such subjects as furnishing the most profitable employment of those hours which you pass in this room. I have considered myself as the pioneer of the several subjects, and have regarded my principal duty to be that of clearing the road for my hearers, of removing difficulties and obstructions, and of disincumbering the language of science of those hard words and unmeaning barbarisms, with which, even in the present enlightened period, some have been fond of obstructing her paths. These are among the idols, alluded to by Lord Bacon in his suggestions for the advancement of learning, and I feel that I am not deceived, when I flatter myself that the Lectures of this Institution have gone far to banish their worshippers from among the pursuers of knowledge, for science to be revered requires only to be *really* known; to be seen unadorned and simple; to be stripped of the verbiage of the schools.

In selecting mineralogical chemistry as the subject of my lectures for the present season, I have been in great measure guided by its very important and extensive bearings upon many of the useful and ornamental arts, a circumstance sufficiently obvious, when we consider the numerous wants and luxuries which are supplied by the products of inorganic nature. In thus treating of the metals, for instance, it will be my object to point out the situations which they occupy in the bowels of the earth, the peculiar rocks and strata in which they occur, and the history of their discovery; to this will succeed an account of the mechanical and chemical operations to which they are submitted, in order to render them fit for the purposes to which they are applied in the arts, and this will include a succinct account of their general mechanical and chemical qualities, and of the processes of analytic chemistry, in regard to them. These would form admirable subjects of illustration, and would give the lecturer an opportunity of entering upon a field of great and interesting extent, in any school or establishment more liberally endowed than the Royal Institution of Great Britain; and an excellent course of instruction might be reared upon such foundations. For this purpose, models would be required of the various machinery and apparatus employed in our manufactures, their principles should be expounded, and their merits discussed, and thus an opportunity would be afforded to every one of becoming acquainted with an important and most essential source of the wealth, strength, and independence of our country. Some of those whom I have now the honour to address, may perhaps remember that something of this kind was attempted here, and that several models were kindly and liberally lent us by Mr. Farish for the elucidation of certain mechanical arts; the very circumstance however of that undertaking were such as to cramp its success, and I cannot but hope, that at some more fortunate period than the present the subject may meet with support and attention, and that we may be enabled to expend a sum of money in the channel I have glanced at. Such an undertaking would be equally useful to almost all classes of society; the unlearned in such

matters would be instructed, the knowledge of the well informed would be renovated, and improvements might be suggested by that rare union of talent and ability enrolled in the lists of our members.

While however I am lamenting that our means are thus greatly limited, I would not be considered as under-rating that which is in our power, or as undervaluing that which has been actually achieved within these walls. On the contrary, our establishment has gone far beyond all others in these respects; by diligence and economy we have raised collections which, if not as splendid, are yet as useful as any in the kingdom. The science of chemistry, in particular, has here received an impulse which can only be compared to that given to mechanical philosophy by the sublime discovery of the theory of gravitation; it has been as extensively felt in its effects and applications; other branches of science and the arts have been ably elucidated and popularly explained; and, on the whole, it would be difficult to adduce any institution which at any period has been more signally conducive to the promotion of science, or in which the true objects of philosophy have been more actively or successfully cultivated.

During the latter part of the last season I submitted to your consideration some general views respecting the structure of the earth's surface, and presented you with an outline of the most celebrated and plausible geologic theories, and in the present course I shall resume that subject as far as it is connected with the history of the metallic bodies.

The very scanty information of the ancients in this department of knowledge, and the sparing progress made in it previous to the last century, will furnish some striking proofs of the benefits that have resulted to mankind from the union of theoretic with practical skill, and will expose in a striking and strong light, the advantages to be derived from the combination of mechanical with chemical knowledge; for previous to the discovery of the steam engine many of the most important products of the mines of England were unattainable, and even when this giant of mechanism had rooted them from their subterraneous abodes, they lay as useless lumber upon the

surface, till submitted to the researches of the analytic chemist. Copper now ranks among the principal riches of the Cornish mines, but for a long series of years the miner's attention was exclusively directed to tin, which usually lies uppermost in the veins. Chemistry pointed out the value of the former ores, and the draining pumps of the steam engine gave him access to the treasure. There are other facts of general interest and economical application, which this part of my subject will lead me to notice, and in many points where my own information is deficient, and where the topics to be discussed are not within my department, you will receive assistance and information from the abler hands of my colleague in mechanical philosophy.

When the geographic and geologic history of mineral substances has been adverted to, we are next to turn our attention to those characters by which they are recognised and distinguished; this induces me to regard them under three points of view, viz. as to external or mechanical characters; as to chemico-mechanical, or crystalline forms; and as to chemical characters, by which of the three methods they are most successfully and correctly distinguished.

Some of the Greek and Roman writers, and more especially Theophrastus and Pliny, have attempted descriptions of minerals with considerable minuteness, and the Roman historian has occasionally enlarged upon their chemical applications; but the profitable study of the distinctive characters of minerals is of very recent date, and for precise information we must consult our own times.

Avicenna is, I believe, the first who subdivided mineral bodies into stones, salts, inflammables, and metals, and in the multifarious writings attributed to that philosopher, we meet with a variety of observations concerning their formation and qualities. I mention this classification, as it has been more or less adhered to by all subsequent mineralogists, and especially by Agricola, who has sometimes been emphatically designated the father of mineralogy; he certainly did work hard at that science, but deserves more credit as a metallurgist; and in his work entitled "*de re metallicâ,*" has laboriously expounded

the various operations practised in his day for reducing the metals from their ores, and rendering them fit for the purposes of commerce and the arts. This is a book the perusal of which cannot but amuse, and those who will not be at the trouble of reading the letter-press, will find the wood-cuts not unentertaining: Agricola died at Chemnitz about the middle of the sixteenth century. Cæsalpinus and Aldrovandus we pass over, as the copyists of Agricola, and find nothing worth recording in the history of mineralogy, until the publication of the *Physica Subterranea* of Beccher in the year 1667. He considered minerals as composed essentially of three elementary principles; salt, sulphur, and mercury; and has arranged them under the ideal predominance of one or other of these fancied elements; he classes the metals under three divisions; gold and silver form the first, and melt at a red heat; copper and iron must be heated to redness before they can be fused; and tin and lead melt before we can make them red hot. Upon a former occasion I have sketched the merits of Beccher as a chemical theorist, and it is there that he principally shines: as a mineralogist he is fanciful and speculative, without being either instructive or entertaining. Pott, Linnæus, Wallerius, Cronsted, and Engstrom form links in the chain of mineralogists which conducts to our present systems, and Werner and Haüy now require something more than the mere mention of their names.

To one who only superficially considers the matter, it might appear easy so to describe any particular mineral, as to enable us to recognise and distinguish it from others; but here, as in many other cases, there is a wide difference between theory and practice, and we presently find ourselves beset with difficulties and entangled in contradictions.

Werner has achieved wonders in the invention of a language for describing the external characters of minerals, and his essay on this subject, published, I believe, in 1774, gave mineralogy a degree of celebrity which it had never before enjoyed. It is not difficult to state the merits and defects of this system.

Werner divides the external characters of minerals into

general and particular, and of the former, *colour* is dwelt upon as most efficiently distinctive. There are eight fundamental colours, and to these a variety of subordinate or secondary tints is attached, the effect of which is to render the primary definition perfectly confused and indeterminate. To describe a peculiar colour as appertaining to a particular class of minerals, or to particular individuals, is making a sober and proper use of this external character; but where substances occur, which is usually the case, of several different colours, their enumeration becomes useless as a distinctive character, and carries with it an air of affectation and frivolous absurdity, which tends greatly to injure the really useful part of Werner's characters. *It is scarcely possible to open a page of the Wernerian system, without being appalled at these discordant enumerations, or startled at the palpable obscurity of his definitions. Cohesion, unctuosity, coldness, specific gravity, smell, and taste, are the remaining general characters; and among the particular characters, the fracture, lustre, hardness, and transparency, are principally dwelt upon. Of these characters, specific gravity ranks, perhaps, first in importance. By this term, we mean the weight of any substance compared with the weight of an equal volume of any other body, and distilled water of the temperature of 60°. is taken as unity. If I plunge a body into water, it displaces its own bulk of that fluid, the weight of which is equal to its appa-

* Spinel Ruby. The principal colour is red, from which there is a transition on the one side into blue, and almost into green; on the other side into yellow and brown, and even into white. Thus it passes on the one side from carmine red into cochineal red, crimson red, and cherry red, into plum-blue, violet blue, and indigo blue; the indigo blue sometimes inclines to duck blue, *which is nearly allied to green.*—On the other side it passes from crimson red into blood red, and hyacynth red, into a colour intermediate between orange and ochre yellow, into yellowish brown and reddish brown. From the cochineal red it passes through rose red into reddish white. The colours are seldom pure, being generally somewhat muddy, &c. See Jameson's Mineralogy, vol. i. p. 28, 2nd edit.

rent loss of weight by immersion. If, for instance, a mineral weighing 3 oz. loses 1 by immersion in water, the weight of a volume of water equal to that of the immersed mineral is 1 oz. In saying then, that the sp. gr. of gold is 19, &c. I mean, that it is 19 times as heavy as an equal bulk of distilled water. Thus the quotient obtained by dividing the absolute weight of a substance by the weight of its bulk of water, is its sp. gr. Thus if a body weighs, in air, 360 grs. but loses 60 grs. in water, its sp. gr. is 6. for $360 \div 60 = 6$.

The hardness of minerals is very various, and is usually expressed by their power of scratching, or being scratched by other bodies of known and uniform hardness. *Hard minerals* do not yield to the file; they strike fire with steel, and scratch glass; others yield to the knife; others may be scratched with the nail.

Fracture is *conchoidal*, as *flint*.

Vitreous—as *quartz*.

Foliated—fine grained—uneven, &c.

The general structure is, foliated—fibrous—radiated—compact, &c.

The classification of minerals adopted by Werner, is little else than that of Avicenna. They are divided into

Stones,
Salts,
Combustibles,
Ores.

The principal fault of Werner's mineralogical arrangement, consists certainly in the stress which is laid upon the variable and uncertain quality of colour, and the painful prolixity with which its shades and transitions are enumerated. This has, by some, been unjustly siezed upon for the purpose of casting ridicule over the whole system, which we shall afterwards, however, find that it by no means merits.

The other systematic mineralogist to whom I have alluded is Haüy, who has made the theory of crystallization essentially subservient to the description, and also to the classification of minerals. Romé de Lisle was the first to enter upon this investigation, and Haüy pursued it with infinite diligence and considerable success.

Crystallized substances are inclined to assume a great variety of forms, but when minutely examined, it will be found, that they are reducible to a few simple geometrical figures

These forms are invariable in bodies of the same chemical composition, but when that varies their forms also vary: thus the primitive rhomboid of calcareous spar, has obtuse angles of 105°. 5′. of magnesian carbonate of lime of 106°¼, and of iron spar 107°. The tourmaline is a mineral which has also an obtuse rhomboid for its primitive form: its angle is 113°. 34.′*

According then to Haüy, bodies resembling each other in form and composition, constitute a mineralogical species.

We find that both Werner and Haüy are obliged to call in the aid of chemical characters, in order to complete the definitions and descriptions of minerals; and the further we proceed, the closer shall we find the relations between these sciences.

In speaking generally of the chemical characters of minerals, I do not at present allude to their minute analysis, which teaches us the relative proportion of their component parts: that subject will cost us the much time hereafter. I mean only to speak now of such properties as are presently recognised without any difficult or complicated operation.

Of these, the relative fusibility of different bodies may be first noticed, which is best ascertained by a common blowpipe. Small fragments of minerals may be easily heated white hot by this instrument, and their behaviour at this temperature often presents us with a distinctive character.

There are various methods by which the powers of the blow-pipe, as to heat, may be considerably augmented, and by which it may be rendered more convenient.

* The different goniometers, and the methods of using them, were here described. The most accurate, and most generally useful, is that contrived by Dr. Wollaston, in which, instead of employing the surface of the crystal as radius, a ray of light reflected from its surface, is used for that purpose. See Phil. Trans. 1809. This instrument has been turned to very valuable account in the crystallographical researches of Mr. Phillips. See Geol. Trans.

But the greatest known heat is produced by a mixed current of oxygen and hydrogen, as the researches of Dr. E. D. Clarke have shewn; (see vol. ii. p. 104 of this Journal.)

This instrument has well nigh banished the term infusibility from mineralogical language, and certainly is very convenient for the production of a very intense heat, confined to a very small space. The action of acids often enables too to judge of the nature of mineral bodies, and especially to detect the carbonates by effervescence.

I have thus, as preliminary to more precise information, enumerated some of the leading characters which are to be recognised by the describers of minerals, and the assemblage of which is to enable us adequately and correctly to enumerate their distinctive characters.

The subject of general classification is reserved for a future lecture.

I must now beg to inform you, that abstract mineralogy is by no means the intended matter of these lectures, but that the subject will be treated of upon a more extended, and I venture to hope, a more useful and interesting plan. The products of the mineral world, indeed, form the sole objects of our inquiries; but we shall regard them not merely as objects of natural history, but as subservient to the common purposes of life. In thus contemplating my subject, we shall soon perceive how much the bounty of Providence has left to the industry of man—how artificial most of our wants are—and to what extent ingenuity has been tortured to minister to luxury and refinement. Man first becomes active from want, but in gratifying his wants, he opens to himself sources of new enjoyments; the sphere of his desires become enlarged, new objects stimulate his ambition, and thus the energy of the mind is ever preserved alive. It is in this way that one discovery becomes the parent of others—and thus, that the arts and sciences have been, and will continue progressive. It is very edifying to retrace the different branches of human knowledge, to observe the insignificance of their sources, and to watch their evolution and growth—to see their importance augmenting with time.

The ancient modes of reckoning time by the graduated candle, the clepsydra, and the hour-glass, led by slow but regular steps to the pendulum clock, and this to the more delicate mechanism of the spring watch. The moveable spheres of the Greek astronomer, and the cycles and epicycles of the Ptolemaic school, have been eclipsed by the Newtonian theory.

It is pleasing, says Dr. Johnson, to contemplate a manufacture rising gradually from its first mean state by the successive labours of innumerable minds; to consider the first hollow trunk of an oak in which a shepherd could scarce venture to cross a swollen brook, enlarged at last into a ship of war, attacking fortresses, terrifying nations, setting storms and billows at defiance, and visiting the remotest parts of the globe. And it might contribute to dispose us to a kinder regard to the labours of one another, if we were to consider from what unpromising beginnings the most useful productions of art have probably arisen. It is said that glass was accidentally discovered by some merchants, who with a ship load of soda from Egypt had cast anchor at the mouth of the river Belus in Phœnicia, and were dressing their dinner on the sand, &c. Who, says the writer I have just quoted, and the passage is an admirable specimen of turgid eloquence. Who, when he saw the first sand or ashes, by a casual intenseness of heat, melted into a metalline form rugged with excrescences, and clouded with impurities, would have imagined that in this shapeless lump lay concealed so many conveniences of life, as would in time constitute a great part of the happiness of the world. Yet by some such fortuitous liquefaction was mankind taught to procure a body at once in a high degree solid and transparent, which might admit the light of the sun, and exclude the violence of the wind; which might extend the sight of the philosopher to new ranges of existence, and charm him at one time with the unbounded extent of the material creation: and at another, with the subordination of animal life; and what is of yet more importance, might supply the decays of nature, and succour old age with subsidiary sight. Thus was the first artificer in glass employed

though without his own knowledge or expectation; he was facilitating and prolonging the enjoyment of light, enlarging the avenues of science, and conferring the highest and most lasting pleasures; he was enabling the student to contemplate nature, and the beauty to behold herself.

Every page of the history of science records the unexpected extension of apparently insignificant discoveries, and it is more than probable that posterity will smile upon the knowledge of the present age, with the same complacency that we now contemplate the ignorance of former times; it was an irrational complaint of a late philosopher, that his existence had not been reserved for a future age, when knowledge should approximate perfection; facts will accumulate and new sources of information rush upon us, but the boundaries of knowledge will always recede.

Art. IX. *On the Cause of the Diminution of the Temperature of the Sea on approaching Land, or in passing over Banks in the Ocean.—By Sir* H. Davy.

In the Third Number of the Journal of Science and the Arts an extract of a letter from my brother, Dr. Davy, has been published, containing some observations on the temperature of the ocean and the atmosphere in the equatorial parts of the globe. I have since communicated to the Royal Society a long letter which he has written on this subject, and which will be published in the next volume of the Transactions. Amongst other philosophical remarks, those by which he confirms the conclusion of Mr. Jonathan Williams* and other observers, that the temperature of the sea always falls in shoal water, and that the thermometer may be made an useful instrument in navigation, appear to be very important.

Mr. Williams attributes the effect upon the thermometer on the approach of land to the cooling power of the land; but

* Thermometrical Navigation, Phil. 1779.

this reason will not apply to the effect of shoals in the ocean, or to the tropical climates. M. de Humboldt, in his personal narrative, seems to consider it as resulting from cold currents below the surface; but in his work he *does* not enter into any minute details, nor in a conversation which I had with him on the subject did he pursue it any further than in mentioning this general opinion. Dr. Davy has merely noticed the fact as a general law; but has not speculated upon the cause of it.

The great interest of the subject to the practical navigator has induced me to consider the theory of it rather minutely, and I shall now detail my views. The same reasons, I have no doubt, either have occurred, or will occur to M. de Humboldt and to Dr. Davy; but I am sure no apology will be necessary for anticipating those either to my brother, or to the illustrious Prussian traveller, whose candour and urbanity are equally distinguished with his knowledge and sagacity.

The solar rays produce very little heat in passing through the air; but during their transmission through a body so imperfectly transparent as water, there can be no doubt that the same cause which occasions a loss of light must communicate an effect of heat, and consequently the greatest heat must be produced at the surface of the sea, and it must gradually diminish as the rays penetrate deeper.

The heat of the surface of the ocean must, at a great distance from land, depend upon the absorption of the solar rays: the cooling of this surface upon its radiating powers, and upon evaporation. But water is an imperfect conductor of heat; and by cooling as far as 38 or 40 of Fahrenheit, its density is increased: when cooling agencies act upon an unfathomable ocean, the strata of water *cooled* sink out of the reach of the surface, and very little influence the temperature of this surface; but when cooling agencies act upon a shallow part of the ocean, the cooled strata accumulate and approach nearer the surface, and cause the temperature of the ocean, at its surface even, to be nearer the mean temperature of day and night.

In *very shallow* water close to the shore, the bottom will be heated; and during the day the temperature close to the

shore will be higher than that of the ocean; but in the night, as the land cools faster than the sea by radiation, the air having its temperature lowered by contact with the cooled land, will flow down upon the sea, and thus will destroy the effect of the hot water flowing from the extreme shallows, and at a certain moderate distance will produce such a diminution of temperature as will more than compensate for the heat produced by contact with hot land. Hot air and water, within limits above 52°. always rise; cool air and water above 40°. sink; therefore, by whatever cause cool air or water are kept near the surface of the ocean, that cause will diminish the general temperature of that surface.

It has been supposed by Mr. Perron, and other enquirers, that ice may exist at the bottom of the ocean; but simple physical reasons shew that this is impossible, unless the temperature of the surface of the ocean is below 40°. for water at 40°. is heavier than at the freezing point. Ice, as Count Rumford has shewn, always forms at the surface; and ice at the bottom of any part of the ocean, must begin to thaw when the temperature of the surface is above 40°. for hot currents then descend and cold ones rise.

The same causes must always operate, where the heat of the surface of the ocean is above 52°., and under these circumstances, whether in the equatorial, polar, or tropical climates, land or shallows must always lower the temperature of the ocean: but in very high latitudes, if the heat of the surface should approach to 40°. only, the thermometer will no longer be a guide of land to the navigator, for water is heavier at 47°. than at the freezing point 32°: but such an occurrence can only happen in icy seas.

Art. X. *New Neapolitan Botanical Works.*

Appendix *prima ad catalogum plantarum Hortii Regii Neapolitani, anno* 1813 *editum; cum appendice plantarum.* Floræ Neapolitanæ *que nondum in Horto Regio coluntur; adjectâ* Synopside *Novarum Plantarum quæ in Prodromo Floræ*

Napolitanæ anno 1811-13 *editio describuntur.* Autore Michaele Tenore, Eq. aur. et M. D. Neapoli, 1815. 8*vo.* *pagg.* 76.

We have not seen the catalogue to which the above is an appendix. The present part is a naked enumeration of the names of plants in the royal botanic garden at Naples. With the exception of some new species indigenous of that part of the world, we have met with nothing which is not well known in the collections of this country. But the concluding Synopsis of the new species contained in the Flora Napolitana, a work which we have not met with, as far as we can judge from a very slight inspection, seems important, and contains fully expressed diagnoses of one hundred and eighty-five unpublished, or rare species, with critical observations. If such have been substantiated after due attention to synonymy, so often and so reprehensibly neglected by the French and Italian botanists, a very valuable acquisition to European botany has been made. We regret that the Italian publications find their way so slowly into this country.

Flora Napolitana; an account of the indigenous plants of the Neapolitan territory, together with some exotic ones cultivated in the royal botanic garden at Naples; by Dr. Tenore.

The first volume of this work was completed in 1815; it is in atlas folio, on vellum paper, and contains one hundred leaves of letter-press, with fifty engravings coloured from nature, and costs 100 ducats, or 440 livres, about 20 pounds. The work is to be completed in four volumes of nearly equal extent. The Linnean arrangement has been followed; the text, except in the specific diagnoses, is in Italian, a fasciculus of ten leaves and five plates is published every fourth month. About 3000 species, of which 200 are deemed either entirely new, or as having been imperfectly known, will form the contents of the whole publication.

ART. XI. *Proceedings of the Royal Society of London.*

THURSDAY, *March 6th.*—A paper was communicated by the Rev. F. H. Wollaston, describing a thermometer, calculated for measuring heights. It is well known, that the boiling points of fluids is regulated by the pressure of the superincumbent atmosphere, and that the higher we ascend, or in other words, the lower the barometer is, the less is the temperature required to boil water. Accordingly, the temperarature at which water boils, is inversely as the barometrical pressure. Mr. Wollaston here describes a thermometer, the construction of which is so delicate, as to be capable of indicating the difference of temperature required to boil water upon a table, and upon the ground; consequently, the heights of rooms, houses, churches, and mountains, are easily ascertainable by it. The instrument is most ingeniously contrived, but cannot be well understood without the plate. The first effect of expansion drives the mercury from the great bulb into a smaller one just above it, and then, as the boiling point approaches, the quicksilver passes into a capillary tube of such fineness, that 1°. occupies about an inch in length of the tube ; and the height of the mercury is read off by a properly applied vernier. We must refer our readers to the paper in the Transactions for the method of using this very delicate instrument, and also for the evidence of its correctness.

March 13. Mr. Pond gave in an appendix to his former paper on the parallax of the fixed stars.

March 20. A paper was communicated by the President, from Mr. Marshall, giving an account of the culture and produce of the *laurus cinnamomum*, or cinnamon laurel. The reading of this paper was continued on the 27th, and terminated on Thursday, the 17th of April. Its length prevents our giving an intelligible abstract of its various contents, in the limits we can afford.

At the same meeting, three mathematical papers were presented to the Society; two by Thomas Knight, Esq., and a

third by Charles Babbage, Esq. containing observations on the application of analogical reasoning to mathematical investigations. These papers were not of a nature to be read to the Society.

April 24. An account of an electrical increaser, was read, communicated by H. Upington, Esq. through Dr. G. Pearson. It appeared to differ but little from the *multiplier* already known to electricians.

May 1. A paper of much interest to physiologists, was communicated by Sir E. Home; containing many new facts respecting the passage of the ovum from the ovarium to the uterus.

The facts detailed in this paper, were illustrated by several very beautiful drawings from the microscopic pencil of Mr. Bauer, whose talents promise to be of as valuable application to anatomy, as they have already proved to the botanist.

May 8. A paper was read by Sir Everard Home, entitled, Further Observations on the Use of the Colchicum autumnale in Gout. It may now be considered as proved, that Colchicum is the active principle of the justly celebrated eau-medicinale, for a vinous tincture of that root, has cured many persons of the gout, exactly in the same way as the French remedy. Sir Everard furnishes sufferers from gout with a curious fact, in this paper, viz. that the part which gripes and vomits, is contained in the sediment of these tinctures, and that although the clear part certainly cures the gout, it does not produce those rough effects which seem to belong exclusively to the sediment; he therefore advises filtering the eau-medicinale, to get rid of this mischievous deposit.

At the same meeting, a paper was presented by Thomas Andrew Knight, Esq. containing observations on the extent of the expansion and contraction of timber in different directions, relative to the medulla of the tree. This paper seemed to throw some light upon the obscure question of the motion of the sap in trees.

May 22. Mr. Sewell, assistant professor at the Veterinary College, gave a short account of a mode of curing a chronic lameness to which hunters, chargers, and other valuable

horses are liable, after any considerable exertion. It consisted in dividing the nervous trunk, and extirpating a portion of it, where it enters the foot behind the pastern joint. A successful case was annexed to the paper. At the same meeting, Sir H. Davy presented to the Society, a letter from his brother, Dr. Davy, containing a series of observations on the temperature of the ocean and atmosphere, and on the density of sea water. This paper forms part of a journal kept by Dr. Davy, in his voyage to Ceylon, and embraces several curious topics of inquiry.

Art. XII. *Proceedings of the Royal Society of Edinburgh.*

April 7. Mr. Campbell read a paper on the theory of vision. He stated the opinions of Dr. Reed, Paley, and philosophers in general, to be, that the sensation of vision is produced by pictures painted on the retina—pictures similar to those which may be formed on the hand or the cheek, by means of proper glasses. This opinion he opposed, on the ground that no such pictures are formed in the human eye, the retina being so transparent, as to *transmit* all the rays of light, and these, when they have passed through the retina, being all *absorbed* by the choroides. He proposed, as an explanation of the problem, the following theory. Vision consists in two kinds of perception—the discrimination of dimensions and figure, and the discrimination of colour. In discriminating dimensions and figure, the eye obtained information similar to the organ of touch, an assemblage of rays, corresponding exactly in figure and relative dimension to the body seen, penetrating the retina, and exciting there a corresponding area of the optic nerve. In discriminating colour again, the power is more analagous to that of the organs of smell and taste. The different coloured rays having peculiar modes of affecting the retina, excited the area differently, according to these peculiar modes; an excitement

is thus produced on the retina, or optic nerve, by which it communicates information to the mind, and intimations of the figure and colour of visible objects.

A paper from Dr. Murray was read, on the means of obviating the risk of explosion in the newly invented blow-pipe of Mr. Brooke. The difficulty that has been found in the methods formerly employed, of having two separate reservoirs, is that of adjusting the issue of the gases in the requisite proportion of two volumes of hydrogen to one of oxygen, a difficulty which by any adjustment of pressure, or of area of tube, is not easily obviated.

Dr. M. conceiving that the method of having two reservoirs, must always be superior in safety to that of having the gases mixed in a single reservoir, thought of obviating this difficulty, by forming a combustible mixture, the volume of which would be equal to that of the oxygen necessary for the combustion. Such a mixture is obtained by the addition of a requisite proportion of olefiant, or of coal gas. From the results of some experiments, the heat produced by such a mixture, seemed scarcely equal to that with pure hydrogen: but the experiments had not been brought to such accuracy as to render it certain, that this might not be owing to some adventitious circumstances.

Dr. M. also proposed another method which, on the whole, he thought preferable, in which pure hydrogen is used, that of having three reservoirs fixed down on a board by a cross bar, one of oxygen with one of hydrogen on each side, connected with a tube from each, with stop-cocks, and terminating in a common tube, fitted also with a stop-cock. The gases would thus be easily presented to one another in the requisite proportion, and all the risk completely obviated.

April 21. A paper by Dr. Brewster was read containing an account of some new properties of light and of crystallised bodies, which he had lately discovered. Some of these properties were exhibited before the Society.

At the same meeting a paper by Dr. Trail of Liverpool

was read. It contained an analysis of a new mineral substance which he found at Stromness in the Orkney Islands. It consisted of sulphate of barytes and carbonate of strontian, but it did not appear to be ascertained that these ingredients were in a state of chemical combination. Dr. Trail proposed to call the mineral *Stromnessite*, from the place where it was discovered, or *Barystrontianite*, from its composition.

May 5. Dr. Hope exhibited to the Society an improvement upon the new blow-pipe, by which it is rendered perfectly secure from explosion. This improvement consisted in interposing about *one hundred* folds of wire-gauze between the reservoir which holds the gasses, and the mouth from which they issue.

At the same meeting Dr. Dewar exhibited a specimen of a phial which he proposes for preserving volatile and deliquescent substances accurately from communication with the surrounding air by means of mercury. The phial was made with a deep rim round the shoulder, which was intended to contain a small quantity of mercury, and into this the mouth of an inverted glass cover, enveloping the mouth and stopper of the phial was to be immersed. This apparatus Dr. Dewar conceived would contribute materially to the convenience of the practical chemist, the druggist, and others, in a considerable variety of instances.

On the 19th a paper by Mr. Stevenson, civil engineer, was read, regarding the operation of the waters of the ocean and of the river Dee, in the basin or harbour of Aberdeen. From which it appears, that Mr. Stevenson, in the month of April, 1812, with the use of an instrument (of which he exhibited a drawing) has been able to lift salt water from the bottom, while it was quite fresh at the surface, and has satisfactorily ascertained that the tidal or salt waters keep in a distinct stratum or layer under the fresh water of the river Dee. This anomaly with regard to the salt and fresh waters appears in a very striking manner at Aberdeen, where the fall of the Dee is such as to cause the river water to run down with a velocity which seems to increase as the tide rises in the harbour, and

smooths the bed of the river. These observations shew that the salt water insinuates itself under the fresh water, and that the river is lifted *bodily upwards;* thus producing the regular effect of flood and ebb tide in the basin, while the river flows downward all the while with a current which, for a time, seems to increase as the tide rises.

These facts with regard to the continual course of the river Dee downward is such a contrast to the operation of the waters of the Thames, as seen by a spectator from London bridge, that Mr. Stevenson was induced to extend his experiments to that river, in the years 1815 and 1816, by a train of experiments and observations from about opposite to Billingsgate all the way to Gravesend.

The waters of the Thames opposite the London Dock gates were found to be perfectly fresh throughout; at Blackwall, even in spring tides, the water was found to be only slightly saline; at Woolwich the proportion of salt water increases, and so on to Gravesend. But the strata of salt and fresh water are less distinctly marked in the Thames, than in any of those rivers on which he has hitherto had an opportunity of making his observations. But these enquiries are meant to be extended to most of the principal rivers in the kingdom, when an account of the whole will be given.

From the series of observations made at and below London bridge, compared with the river as far up as Kew and Oxford, Mr. Stevenson is of opinion, that the waters of the Thames seldom change, but are probably carried up and down with the turn of the alternate tides, for an indefinite period, which he is of opinion may be one, if not the principal cause of what is termed the extreme softness of the waters of the Thames.

Mr. Stevenson has made similar experiments on the rivers Forth and Tay, and at Loch Eil, where the Caledonian Canal joins the western sea. The aperture at Curran Ferry for the tidal waters of that loch, being small compared to the surface of Loch Eil, which forms the drainage of a great extent of country. It therefore occurred to Mr. Stevenson, that the waters of the surface must have less of the saline particles than the waters of the bottom. He accordingly lifted water

from the surface at the anchorage off Fort William, and found it to be - - - - - - 1008.2

At the depth of 9 fathoms - - - 1025.5

At the depth of 30 fathoms in the central parts of the loch it was - - - - - - 1027.2

Indicating the greater specific gravity, and consequently more of the saline particles, as the depth of the water is increased.

At the same meeting a notice by Dr. Brewster was read. It relates to the discovery of a general principle respecting forces which emanate from the axes of doubly refracting crystals.

June 2. The Rev. Mr. Morehead read a paper entitled Observations on the Agamemnon of Æschylus, illustrated with translations.

At the same meeting Dr. Gordon communicated an account of the circumstances attending a narrow escape which Mitchell the blind and deaf boy had made from being drowned.

16. Mr. Morehead concluded his observations on the Agamemnon of Æschylus.

A communication on the laws of double refraction and polarisation, by Dr. Brewster, was laid before the Society.

The meetings of the Society were adjourned till the first of November.

Art. XIII. *Miscellanea.*

I. *Remarks on a Note in the Second Number of the Journal of the Royal Institution. By Sir* H. Davy.

In a Paper printed in the Second Number of this Journal, I have mentioned that M. Guy Lussac, in his first experiments on iodine made with M. Clement, supposed that it afforded muriatic acid. M. Gay Lussac, with whom I had the pleasure of conversing, during a late visit that I made to Paris, informs

me that he did not assist M. Clement in those experiments, but that they were made in his laboratory.

When the analogy between hydroiodic and muriatic acids are considered, it is not difficult to conceive how they should have been at first confounded even by so skilful and accurate a chemist as M. Clement; and it is only in examining either their recondite properties or their combinations that they can be distinguished. Through the kindness of M. Ampere and M. Clement, I had made some experiments on iodine, before M. Gay Lussac had seen this substance, and assisted by my theory of the combinations of chlorine, I immediately formed the conclusion now generally adopted respecting its nature. I have never wished to arrogate to myself any merit in the history of the researches made respecting a discovery belonging to another country, and I take this opportunity of assuring M. Gay Lussac that the note which called forth the animadversions to which I replied, was more painful to me than it could have been to him. The merits of that school of chemistry, of which he is so distinguished an ornament, require no vindication. They are felt by the chemists of the present times; and they will convey its glory to remote posterity.

This subject of critical discussion carries me to another: M. Gay Lussac put into my hands, when I was at Paris, a work published some years ago on eudiometry by himself and M. Humboldt, which contains some very curious observations on the effect of the dilution of mixtures of oxygene and hydrogene on explosion; had I been acquainted with these results I should have referred to them in my last paper on flame, as they confirm my general conclusions: and MM. Humboldt and Gay Lussac have anticipated me in some of my objections to that theory which supposes *condensation* the cause of those combinations resulting from increase of temperature.

I recommend the whole essay as highly deserving perusal, and as a model of ingenuity and accuracy in physical research, worthy of its celebrated authors.

II. *Cheltenham Waters.*

At the request of Dr. Jameson and Mr. Henry Thompson of Cheltenham, we insert the following.

When the original or old wells had failed to produce a sufficient supply of aperient waters for the consumption of the visitors of Cheltenham, Dr. Jameson began to search for fresh supplies, by boring in a great many different places in the neighbourhood of the town: and on the first of July 1803, he opened a new well at the bottom of Badgeworth-lane, within three hundred yards of the old Spa, for which he was threatened with an action for endangering the existence of that well, the only one then in use. This new one yielded a good chalybeated aperient saline water, but the supply of water being scanty, he afterwards shut it up, and sunk another in the beginning of the year 1804, at the top of the same lane, 40 feet deep, and erected a pump-room over it, called *Sherborne Well*, from the name of the lord of the manor.

This last well afforded such an abundant supply of excellent sulphuretted saline water, that three hogsheads were consumed most mornings, for the space of two years.

In consequence of the great popularity of this well, and the publication of a treatise by Dr. Jameson, promulgating the knowledge that these mineral waters did not come prepared from the adjoining hills, as generally believed, but were generated in the soil of blue clay, containing various mineral substances, and would be found in most situations south of the town, an immediate rise in the value of property took place at Cheltenham, and considerable speculations for building houses then commenced. Mr. Henry Thompson also purchased, soon after this, some fields belonging to the Delabere estate, adjoining Sherborne well, at a great increase of price, which gave rise to the establishment of the present Montpelier wells, situated a little lower, and at less than a hundred yards from Sherborne well.

III. *Building Materials.*

We have long intended to offer a few remarks upon the kinds of stone best calculated for the construction of public buildings, and other monuments of art, and hope in a future number, to say something more explicit than can now be offered upon this subject. As two monuments in commemoration of our naval and military achievements are about to be erected, we trust that some attention will be paid to the fitness and durability of the materials, and that Bath stone, and lath and plaster, will give way to granite and marble.

The architect of the Strand Bridge, though we do not presume to offer any opinion of the taste or skill displayed in the edifice, has set an example worthy to be followed in the choice of materials; the exterior is entirely granite, of two kinds; the one which is chiefly used is coarse grained, and comparatively easily worked; it is the granite of Devon and Cornwall. The other is fine grained, and harder, and is from Aberdeen; it has been selected for the balustrades, and if we mistake not, its strength compared with the Cornish granite, is about as 14 to 22. For columns, therefore, that are to support weight, there is an obvious preference. We have no means of judging of the respective durabilities of these granites, except by the ravages made upon them by the hand of nature, and Cornish granite has evidently undergone more decay than the harder stone of the north. We believe this to arise principally from a difference in the composition of the feldspar.

We have heard it hinted, that no granite will be used in the new monuments, because it can only be worked with a pick, and does not admit of the more delicate efforts of the chisel; but surely the example of the ancients may here be followed, who used granite for the shafts of the columns, and marble for the Corinthian capital, and other parts ornamented by the niceties of sculpture.

Many buildings of London, Edinburgh, Bath, Oxford, &c. &c. &c. furnish melancholy instances of want of judgment in the choice of materials, and though the high reputation of the gentlemen who have been fortunately selected upon the pre-

sent occasion, to devise and direct the Waterloo and Trafalgar monuments, ensures their attention to this subject, we hope they will excuse our reminding them of the necessity of consulting upon it with those who are capable of advising. This is not a matter of taste, but of experiment. The durability of a building stone depends upon many circumstances, and these again are referable to its mechanical texture and chemical composition.

It is sufficiently obvious that any stone which is very porous cannot be durable if exposed to the weather, for water will lodge in its pores, and penetrate into its crevices; and by mere change of temperature, or change of bulk, do infinite mischief; but when frost comes, the power of expansion becomes so great, that in a single winter all the sharp parts often crumble. The aptitude therefore of different sandstones and limestones for the purpose we are now considering, may be pretty correctly judged of by immersing similar pieces of them, previously weighed, in water, and the fitness of the stone will be inversely as the quantity of water absorbed. The magnesian limestone, which is very abundant in England, we consider as best adapted for architectural purposes, and as greatly preferable to the oolites of Somersetshire, and the isle of Portland. As rain water always contains carbonic acid, it also acts chemically upon limestone, but less upon those which are fine grained, and magnesian, than on those which are coarse and free of magnesia; and although this effect is often attended by what is called a *hardening* of the stone, as of the Bath stone, this is only the forerunner of a more quick peeling and destruction.

Where then they are admissible, let granites, sienites, whinstones, and porphyries be used, and where ornament prevents the adoption of these obstinate materials, the sculptor should exert his talent upon marble or dolomite, of which Scotland will furnish abundance, if he does not choose to go abroad for it; or upon the humbler kinds of magnesian limestone, in preference to the perishable sand and limestones of the west of England.

IV. *Annales Maritimes et Coloniales.*

Cet ouvrage périodique parait à Paris tous les mois par cahiers divisés en deux parties. La première comprend tous les actes législatifs, administratifs et judiciaires relatifs, soit à la marine militaire, soit à la marine commerçante et aux colonies. La seconde partie se compose de tous les travaux scientifiques et de tous les resultats d'expériences qui tendent au progrès des arts de la marine. Toutes les sciences qui composent la philosophie naturelle fournissent à ces arts des secours et des moyens variés. Les sciences mathematiques dirigent le navigateur sur une mer où il ne suit et ne connait sa route, qu'à l'aide des observations et du calcul; elles éclairent le constructeur de vaisseaux sur les formes les plus propres à la marche, à la stabilité, à la force, à la durée des navires. Les sciences physiques répandent leur lumière sur la nature et les propriétés des matières premières employées dans les travaux, sur les moyens d'entretien et de conservation de ces matières une fois mises en œuvre. Enfin les sciences médicales trouvent un vaste champ pour leurs observations et pour leurs opérations, dans les circonstances d'une infinite variété où se trouvent des hommes qui vivent tour à tour à terre et sur mer, qui passent en peu de temps des climats les plus froids aux climats les plus chauds, et qui ne peuvent conserver leur santé au milieu de ces rudes épreuves, qu'en réglant leur nourriture, et tout ce qui tient aux usages de la vie sur les principes éclairés d'une sage hygiène.

Le Journal des Sciences et des Arts de l'Institution Royale, ne doit s'occuper que des matières traitées dans la seconde partie des Annales Maritimes. Nous allons dans ce premier article donner une idée succincte des objets les plus intéressants que présentent les douze premiers N^os^: ceux de l'anné précédente.

Nous trouvons d'abord un Mémoire du Roi Louis XVI, pour le célèbre La-Peyrouse. Dàns cet écrit, où respire la plus douce humanité, ce prince indique au navigateur quel doit être le plan et la nature de son voyage, quelles doivent être ses observations, ses recherches et ses collections; enfin quels

soins il doit prendre pour conserver la santé de ses équipages, et ménager leur vie ainsi que celle des sauvages insulaires.

Un voyage plus récent et plus heureux, est celui du Capitaine Baudin aux terres Australes. Le Capitaine Louis Freycinet, qui commandait le Casuarina pendant l'expédition, a redigé la partie géographique et physique de ce voyage ; après avoir imprimé son ouvrage, il l'a soumis à l'examen du Bureau des Longitudes de France ; une commisson composée de MM. Delambre, de Rossel, Biot, et Arago s'est livré à ce travail ; le rapport intéressant redigé par le dernier commissaire est inséré dans les Annales, il fait connaitre la marche suivie dans les observations ainsi que dans les calculs, et présente une idée exacte des difficultés qu'il y avait à vaincre pour parvenir à des résultats qui méritassent la confiance des savans et des navigateurs.

On trouve dans les Annales Maritimes une indication détaillée de tous les nouveaux phares que l'on établit sur les côtes d'Europe pour assurer la navigation. Cest ainsi qu'on trouve dans les Numéros de 1816, la description des feux établis sur les isles de May et d'Inchkeith à l'entrée du golfe de Forth (Frith of Forth), de Tusker sur la côte d'Irlande à l'entrée du Canal de St. George, de Corswal, à la pointe occidentale de Rock-Lyan en Ecosse ; du Fanal des Dunes à Ostende, des trois feux de Cherbourg, &c.

Les travaux hydrographiques forment une des bases importantes des sciences maritimes, et l'on sait à quel point des cartes bien faites peuvent prévenir des naufrages et concourir aux progrès de la navigation.

Le Gouvernement français fait travailler maintenant au perfectionnement des cartes de la Mediterranée, et des côtes de France sur l'océan. M. Gaultier, capitaine de fregate, exécute la première partie de ce travail sur la gabarre *la Chevrette ;* la seconde est confiée à M. Beautemps Beaupré, membre de l'Institut de France, et connu par ses grands travaux hydrographiques de la mer adriatique, de l'Escaut, &c.

Le Gouvernement Anglais ne reste pas en arrière de ces efforts pour la perfection des connaissances maritimes, et il a désigné plusieurs navires pour exécuter des sondes et des

relèvements sur tous les points importants des côtes de la Grande Bretagne. Ces opérations doivent se lier avec les grandes mesures topographiques exécutées sous les ordres du Colonel Mudge, membre de la Société Royale de Londres.

Les Annales présentent l'annonce des Cartes suivantes recemment publiées par le Dépot des Cartes et Plans de la Marine, le plus bel établissement de ce genre qu'il y ait en Europe.

Cartes de la mer Baltique,
du Sund,
du Grand Belt,
du Catégat,
du Skagerak,
de la Baie de Lubeck,
de la Rade de Dantzick,
de la Côte de Portugal depuis le cap Sillero jusqu'à la Barre de Huelva,
de la Barre de Lisbonne et des Côtes adjacentes.

Un mémoire fort étendu sur la navigation au passage du Sund, par M. Froment Champ-Lagarde, Vice Consul de France à Elseneur, présente une foule de renseignements statistiques et commerciaux également utiles pour les marins de toutes les nations qui font le commerce de la mer Baltique, et par conséquent surtout pour les marins anglais.

M. Noël, ancien Inspecteur de la navigation, a publié une histoire générale des pêches anciennes et modernes dans les mers et les fleuves des deux continents. Cet ouvrage, qui annonce une grande érudition, et dont on ne donne encore que l'analyse du premier volume, présente dans ce volume l'histoire des pêches chez les Grecs, les Romains, et les peuples du moyen age. Le second volume contiendra l'histoire des pêches modernes. L'analyse du premier volume est faite par le Capitaine Freycinet, le même qui faisait partie de l'expédition du Capitaine Baudin, et qui va maintenant diriger une nouvelle expédition consacrée au perfectionnement des sciences nautiques.

Nous ne pourrons pas énumérer ici beaucoup d'articles sur divers objets utiles à la navigation et au commerce; ce détail

serait trop étendu ; nous nous hâtons de passer aux travaux qui regardent l'Architecture Navale.

M. Willaumez, Capitaine de vaisseau, a publié une seconde édition du traité de Mâture de Forfait, ouvrage d'un mérite très distingué ; il a enrichi cette nouvelle édition de beaucoup d'observations qui annoncent un homme à qui l'expérience, éclairée par le raisonnement, a révelé beaucoup de verités nautiques : enfin, cet ouvrage est terminée par un Mémoire de M. Rolland, Inspecteur du Génie Maritime, sur la structure des mâts hollandais. On ne saurait trop recommander l'étude de l'ouvrage de Forfait aux jeunes constructeurs de vaisseaux.

M. Thomas, Commissaire de Marine, présente des vues utiles sur l'usage dont les bois de la Guiane peuvent être en France; il donne aussi des détails sur un procédé employé par M. Anderson dans l'Arsenal de la Marine à Plymouth, pour enduire les toiles d'une couleur imperméable, sans rien ôter à leur souplesse et à leur durée ; il parait que les Français n'ont pas pu imiter ce procédé : ils attribuent cette impuissance à l'infériorité de leur savon.

M. Rolland, dont nous venons de parler, donne un mémoire inséré en partie dans les Annales, sur les moyens qu'on emploie en Hollande, pour préserver les clous et les chevilles de fer de la carène des batiments, de la corrosion qui résulte du doublage : ce Mémoire, fruit des propres observations de l'Auteur, présente des faits et des observations très dignes d'être étudiés.

Un Rapport de MM. Laplace, Prony, &c. fait à l'Institut de France sur le Tableau de l'Architecture navale militaire, aux 18e. et 19e. siècles, fait connaitre le plan de cet ouvrage dont l'Auteur a présenté les deux premiers volumes manuscrits. Nous avons dit un mot de cet ouvrage dans le No. III. de ce Journal, page 159 : l'Auteur voyage actuellement en Angleterre pour perfectionner son travail.

Un autre Rapport de l'Institut, redigé, par M. Prony, présente une description abrégée de plusieurs machines très utiles, inventées par M. Hubert, Ingénieur, et exécutées par lui dans l'Arsenal de Rochefort.

Dans le dernier Numéro de 1816, est un compte assez étendu, des expériences faites par M. Dupin sur la flexibilité, la force, et l'élasticité des bois, avec des applications aux constructions en général, et spécialement à la construction des vaisseaux.

Passons enfin aux objets variés qui ont un rapport avec différentes branches de la Marine.

M. Mayer, Professeur de Physique à Goettingen, a publié la description d'une nouvelle boussole d'inclinaison, avec plusieurs observations intéressantes sur la meilleure méthode pour déterminer avec précision les inclinaisons magnétiques. Les Annales présentent sur les phenomènes de l'aiguille aimantée un grand nombre de faits.

Les travaux de M. Moreau de Jonnés, Correspondant de l'Institut, occupent une place très honorable dans les Annales Maritimes; l'un est relatif à l'hygiène militaire des Antilles; l'auteur y traite du choix des troupes destinées à servir aux Antilles, de leur embarquement, de leur traversée, et de leur débarquement; des garnisons, des vivres des troupes, de la discipline intérieure, enfin des hopitaux des Antilles. On conçoit combien un tel plan exécuté par un bon observateur qui a longtemps vécu dans les Antilles, doit présenter de données précieuses, et de moyens utiles. Cet ouvrage ne peut qu'être très avantageux à répandre dans les possessions anglaises de l'Amerique et même en Angleterre.

Les autres ouvrages de M. Moreau de Jonnés, sont, les Observations géologiques sur les ports, les côtes, et les rivières des Antilles; sur les Géophages qui habitent ces isles: une monographie du Trigonocéphale des Antilles, ou grande vipère fer de lance, &c.

Les Annales présentent des détails assez étendus sur un ouvrage intitulé Harmonies Maritimes et Coloniales, par M. la Barthe.

M. Keraudren, Medecin en chef de la Marine, a publié une Dissertation sur l'Atmosphere maritime, un appercu physico-medical sur l'eau de mer; il analyse et présente l'histoire de tout ce que l'on a fait pour décomposer l'eau de mer, ou pour profiter de ses propriétés.

Dans le No. des Annales pour le mois de Mai 1817, on trouve un Mémoire très important écrit par M. Clément, chimiste distingué, sur les moyens qu'il vient d'employer en commun avec le Capitaine Freycinet, pour décomposer l'eau de mer, par le moyen d'un appareil distillatoire, dont nous donnerons un description dans le prochain No. de ce Journal. Par le moyen de cet appareil on obtient une pinte d'eau avec une dépense qui n'est pas la dixième partie d'un penny ; et il ne faut pas un poids de cent cinquante livres de charbon pour obtenir une quantité d'eau pure pesant mille livres. Ainsi, dans les navigations autour du monde, au lieu d'emporter un poids donné d'eau, si l'on emporte un poids égal de charbon, on aura de quoi se procurer près de *sept* fois plus d'eau pure. Le Capitaine Freycinet, dans le voyage qu'il entreprend autour du monde, remplace ainsi son eau par du charbon.

Revenons aux articles les plus marquants qui nous restent encore à faire connaitre dans les Nos. de 1816 ; ils sont,

Un Rapport fait à l'Institut de France, par un commission composée de MM. Arago, Bouvard et Prony, rapporteur, sur des verres plans à faces parallèles travaillés d'après les principes de M M. Richer, père et fils.

Les verres dont il s'agit sont ceux pui s'adaptent aux instruments avec les quels on observe les astres en mer, pour diriger la route d'un vaisseau. Ils ont été essayés à l'Observatoire de Paris, par MM. Bouvard et Arago, et voici comment ce dernier Astronome s'exprime à leur sujet dans un rapport précédent. " Les miroirs qui nous ont été remis ont en général " d'assez grandes dimensions (4 pouces) : en les plaçant de- " vant l'objectif de la lunette méridienne de l'Observatoire, ou " même en regardant avec une lunette grossissant beaucoup, " l'image réfléchie sur leur surface, d'un objet éloigné, nous " avons pu reconnaitre qu'ils n'altèrent pas le foyer d'une " manière sensible, ce qui, au demeurant, semble la condition " la plus facile à remplir. Restait à mesurer l'inclinaison mu- " tuelle des faces opposées. Or, tel est, sous ce point de vue, " la perfection du travail de MM. Richer, que rarement nous " avons reconnu des déviations de *trois* secondes. Un miroir

" anglais dont M. Cauchois avait fait l'acquisition a Londres, " placé dans les mêmes circonstances, a donné des écarts sen- " siblement plus grands."

MM. Richer sont avec MM. Lenoir et Fortin les premiers artistes de France, pour les instruments astronomiques et nautiques. Le dernier a été chargé d'exécuter un cercle de reflexion pour l'Observatoire de Paris; il surpassera en grandeur celui de l'Observatoire de Greenwich.

Un article de M. Chaumont, Ingénieur de la Marine présente un historique intéressant de l'invention des bateaux à vapeur, de leur introduction et de leur propagation en Amérique, en Angleterre et en France.

On a mis en usage dans les Colonies françaises, le moyen de la machine à vapeur pour exécuter les travaux qu'exigent l'extraction du sucre, et de plusieurs autres produits.

Un article décrit les moyens employés par un colon françois dans la fabrication du sucre.

Un Mêmoire très important pour la marine est celui qui donne les résultats d'essais faits en 1810 et 1811, par M. Gicquet Destouches, dans l'isle de Java, pour remplacer le chanvre par d'autres plantes, dans les usages de la navigation. D'après ces essais, la force du chanvre ordinaire reduit en cordage étant exprimée par 685,000 livres, celles des cordages de même graveur mais fabriqués avec d'autres plantes, s'est trouvée,

Celle du chanvre de Java, genre cannabis,	1163,260
Bridoury, du genre asclepias, &c. - -	870,750
Id. - - - - -	1126,000
Pitre ou Manasbally, du genre agavé, &c.	873,960

Cet excès de force montre quel parti il serait possible detirer de ces plantes pour en faire usage dans la marine.

Les Annales Maritimes présentent des notices biographiques sur les Marins les plus célèbres que la mort enlève à la France; Ces notices sont une véritable revue de tous les travaux militaires administratifs ou scientifiques de ces mêmes hommes. Plusieurs sont écrits par M. Delambre, Secretaire perpetuel de l'Académie des Sciences de l'Institut de France: tels sont celles de Fleurieu, connu par ses voyages d'observation,

et ses travaux hydrographiques; de Levèque, traducteur de beaucoup d'ouvrages de marine, et auteur de plusieurs mémoires; et de Bougainville, célèbre navigateur et, dans le temps de sa jeunesse, mathématicien assez distingué pour que ses écrits aient été l'étude de Lagrange.

M. Keraudren donne l'éloge de M. Peron, naturaliste qui fit partie de l'expédition du Capitaine Baudin, et qui à son retour publia la relation de ses recherches dans le genre de l'histoire naturelle.

On a fait dans l'Arsenal de Toulon un Musée Maritime qui contient, ou doit contenir un échantillon de tous les objets d'histoire naturelle et de tous les produits d'art nécessaires aux travaux de la Marine, les machines de toute espèce, les bâtiments de tous les rangs, &c. Une bibliothèque, un laboratoire de chimie pour l'épreuve des substances doivent être adjoints à ce muséum, qui a été organisé par les soins de M. Dupin. Le même auteur donne la description de très belles sculptures faites autrefois par le célèbre Puget pour orner les galères de Louis XIV. Lorsqu'on eût cessé de se servir de galères on conserva, mais sans soin, ces sculptures, dont un rapport de la classe des beaux arts de l'Institut de France fait connaitre tout le prix, en felicitant l'auteur de les avoir tirées de la poussière, et mises en évidence.

Nous citerions plusieurs articles de l'éditeur des Annales Maritimes, M. le Commissaire Bajot, si ces articles ne se rapportaient pas plutôt à l'administration qu'aux sciences et aux arts; nous ne pouvons que l'engager à poursuivre son ouvrage, et à le rendre de plus en plus digne de l'attention des savans et des marins de l'Europe.

V. *Mr. Cockerell's Tour.*

We have the pleasure to announce the return of Mr. C. R. Cockerell, to this country, after an absence of more than seven years, which have been wholly devoted to the study of the fine arts in Greece, and the surrounding countries. There can be but few of our readers who have not heard how much the fine arts are indebted to the exertions and abilities of this gentleman.

We are happy in being able to lay before our readers, a short account of Mr. Cockerell's progress and studies during his absence.

MR. C. R. Cockerell left England in April of 1810, to pursue his studies as an architect, in Greece, and such other countries as might be open to his researches. He visited Constantinople, where he found the oriental architecture used by the Turks, so interesting, and hitherto so little known, as to engage him fully during three months; and whilst there, he completed various plans of palaces, seraglios, kiosks, &c. which it is probable he will, at a future period, give to the public, as they will at once tend to illustrate the manners and customs of Turkey, and afford much useful information. In his way from Constantinople to Athens, he visited the Troad, various islands of the Archipelago and Salonica; and on his arrival there, he had the fortune to meet a society* of travellers, Danes and Germans, already known to the public by many interesting communications. With one of these, the Baron Haller, who had come from Rome with a similar object, he made a survey of all the monuments of Athens, and added many important details to Stuart's work, and has made some essential corrections. It was in the course of this examination, that Mr. Cockerell, and Baron Haller, discovered various principles which they conceive to be unknown to the Greek architect; and the general application of which, they were anxious to prove by the observation of the other monuments of that country. With this view, they undertook to excavate the temple of Jupiter Panhellenius in Ægina; their success exceeded their utmost hopes, for besides a complete restoration of the architecture, they had the good fortune, in conjunction with two other gentlemen,† to discover the statues which formed the compositions enriching the two frontispieces; which, as the earliest specimens of excellent

* Messrs. Bronstedt and Koes, who died in Zante, and Mess. Baron Stackelberg and Linckh.

† Mess. Forster and Linckh.

Greek sculpture, and of the school of Ægina, of which we have no other certain examples, are of the utmost interest, and have deservedly excited the curiosity of the public.

The same party afterwards succeeded in excavating the Temple of Apollo Epicurius, at Phigaleia, in Arcadia; where, besides a very complete restoration of a temple, which is described by Pausanias, as one of the most beautiful in Greece, they had the gratification of bringing to light, the frieze, which enriched the interior of the cella, and which is now deposited in the British Museum.

We understand that Mr. Cockerell, with the Baron Haller, who has confided his share of labours on these subjects, to Mr. Cockerell's direction, means to publish their united observations on the architecture of Athens and Attica, in the form of a supplement to Stuart's works; and the Temples of Ægina and Phigaleia, the former as one of the earliest specimens of Greek architecture, the other, of its perfection, (as it was nearly of the time of Pericles) contain notices essential to the science, not hitherto possessed by the public; particularly on the painting, and other important decorations.

These gentlemen have also carefully observed the mechanical and constructive parts of that architecture, which, we doubt not, will throw considerable light on that branch of science amongst the Greeks;—and their labours promise a valuable addition to that classical collection and publication of Grecian architecture, which, through the exertion of the Dilettanti Society, and other individuals, reflects so much honour to our country.

Mr. Cockerell's avocations led him into Asia Minor, where he completed the tour of the seven churches, making many drawings and observations on those remains, and collecting many inscriptions. He visited Priene, Samos, Miletus, and Crete, where he made plans of the Labyrinth of Minos. From Rhodes he crossed to Patara, and visited the numerous cities and remains on the Coast of Lycia, and collected, besides drawings, a vast number of inscriptions, and in particular, varieties of those in the Lycian character which are

hitherto unexplained;—at Phaselis, in Pamphylia, he had the good fortune to meet Captain Beaufort,* whom he accompanied along the remaining coast of Asia Minor, making drawings of the remains of those unexplored and important antiquities. He then returned with Captain Beauford to Malta, whence he visited Sicily. At Agrigentum, he made a particular examination of the Temple of Jupiter Olympius, or the Temple of the Giants, which was the most considerable of all Grecian antiquity. He succeeded in making a restoration of the original architecture, which is highly curious for the immensity of its size, its singularity, and the extraordinary mechanical powers which he appears to have traced in its construction. He made other remarks on the carpentry of the roofs of the Greek temples, with various details of the remains in Sicily, and plans of the fortifications of the ancient Syracuse, which, as it is probable that they might in part have been directed by Archimedes, or on principles established by him, are highly interesting.

In a second tour, he visited Epirus, Thessaly, and other provinces of continental Greece, and the Ionian Islands. In February of 1816, he passed into Apulea and Naples, where he had the advantage of a six weeks' study of the antiquities of Pompeia; and remained nearly a year at Rome:—at Florence, he formed a groupe of the family of Niobe, in a very plausible manner; his little work on that subject, is well known to our late travellers, and has been highly approved by all the foreign journals of the day. He completed his tour of the Upper Italy, and is just returned to England by Germany and Paris. He has brought with him, the labours of nearly seven years and a half, which, as may be supposed, are very considerable.

No. VI. *Description of a Lactometer.*

The value of milk, as an article of lucrative produce on a farm, is determined by the quantity of cream which it is capable of producing; and as this is known to be affected by the age, health, and provision upon which the animal is nourished,

* This gentleman has, under the directions of the Lords Commissioners of the Admiralty, made an invaluable chart of that unknown coast; and has, besides, published a concise tract, descriptive in general, of the ruins and country.

a simple instrument, by which the relative proportion of cream produced by different animals, or by the same animal, with different food, is shewn, cannot but be acceptable to the experimental agriculturist, and such an instrument has lately been constructed by Mr. Thomas Jones, mathematical instrument-maker, Charing-Cross, which promises to answer the purpose perfectly well.*

It consists of any number of glass tubes, of the same internal diameter, (about $\frac{3}{4}$ of an inch) and each 11 inches long; these are closed at one end, and open, and a little flanched at the other, precisely like the test tubes used in experimental chemistry, and they are mounted in stands in the same manner; at 10 inches from the bottom of each tube, a mark is made upon the glass, having a (0 zero) placed against it, and from this point, the tube is graduated into tenths of inches, and numbered downwards for 3 inches, so that each division is $\frac{1}{100}$th of the tube. Now if several of these are filled with new milk at the same time, and placed in the same temperature, the cake of cream will form at the top, and its thickness or quantity, will be indicated by the divisions; and thus experiments may be made upon the quantities of cream produced by different systems of feeding, or by different animals, under all circumstances, with great accuracy; and by the continual division, the per centage of cream will be evident upon inspection.

VII. *On Cleansing Chimnies.*

As the subject of employing climbing boys for sweeping chimnies, has lately been before the public, and the cruelties which are too often practised upon them, are by this means exposed, it is presumed, any attempt to alleviate the situations of this class of persons must be acceptable, and will be a sufficient apology for introducing the description of a very simple contrivance of a Mr. Le Gros, for this purpose, into this Journal, as it appears to the editors to be as cheap and effectual as any thing else which has been suggested for this purpose.

It merely consists of a small cast iron pulley, to be fixed in a wrought iron frame, which, by means of a clip screw,

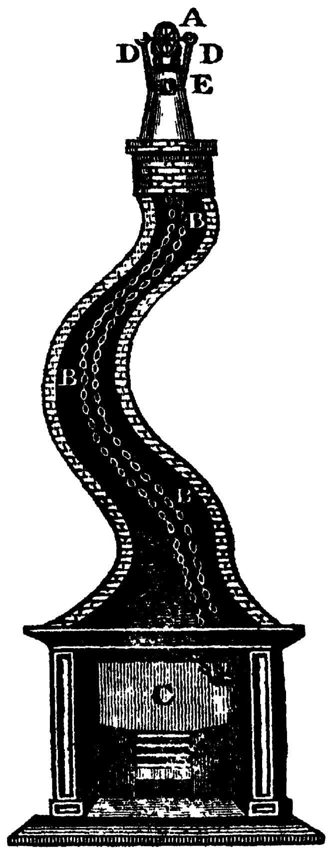
* This instrument was made at the desire of Sir Joseph Banks, who has already described it in the Farmer's Journal.

may be tightly drawn round any sized chimney pot, upon the top of which it is to remain a fixture; over this pulley a light wire chain is to extend, and hang constantly down the chimney, but not so low as to be visible in the fire place, and as this chain is a long loop, or what is generally called a perpetual chain, a brush of any size or kind may be fixed into any one of the links, and by the chimney sweeper who stands below, drawing alternately at one side and the other of the chain, the brush will be carried up and down the chimney, notwithstanding any bends which may be in it, provided they are not very sharp at the angles. Such an apparatus as this may be placed in a chimney of average height for about thirty shillings. The following figure will give a more correct idea of the application of this apparatus.

A. the iron pulley,

B B. the chain extending down to the fire place C.

D D. the wrought iron frame fixed upon the top of the chimney pot by the screw at E.



P. I. Legros, 13, *King-street, Soho-square.*

Art. XIV. *Analytical Review of the Scientific Journals published on the Continent.*

Journals published in Italy.

Giornale di Fisica, Chimica, Storia Naturale, Medicina ed Arti. a Pavia. 1*mo. Bimestre. January and February,* 1817. *By Messrs.* Brungnatelli, Brunacci, e Configliacchi.

The present Number of this valuable and well conducted miscellany opens with a preliminary discourse, giving a summary account of the progress of science during the preceding year, throughout Europe, and more especially in Italy.

Art. I. *Lettera* 1*a. del Sig. Conte Volta, &c. or, Observations on the periodical Returns of Thunder Storms, and the very cold and dry wind generally prevailing after them, when there has been a considerable fall of hail; in a Letter from Volta to Confiliacchj, Professor of experimental philosophy at the university of Pavia.*

The present letter seems intended as a continuation to the meteorological researches formerly published by this author, where he more particularly discussed the mode in which hail is formed. Volta now undertakes to explain a phenomenon in itself highly curious, relative to thunder-storms; namely, their tendency to re-appear for several consecutive days, at the same hour, and over the same tract of country, a phenomenon which the inhabitants of the mountainous districts in Italy never fail to observe in the course of the spring and summer. This is particularly the case in the neighbourhood of the Italian lakes and throughout Lombardy. We remark during those seasons, that if a thunder-storm makes its appearance over a certain valley, or some profound opening in the ridge of mountains surrounding the lake, at the hour of twelve; and if the atmosphere clears towards evening after a shower of hail, another thunder-storm will again occur the next day and for several succeeding days, at the same hour, and over the same place, without any deviation. Nor can this be ascribed to any local disposition, for the same series of phenomena will take place in the same order, over a very different

valley or mountain in the neighbourhood. Volta had occasion to observe this peculiar fact, for several years, though undescribed by authors who have written on meteorology, and tried in vain, for a long while, to explain it. Having, however, paid more attention of late to atmospheric electricity, he thinks he has ascertained the cause of the phenomena. He first supposes, that where a thunder-storm arises in serene weather succeeding a thunder storm of the preceding day, such a repetition must be owing to some particular modification imparted to the column of air in which the phenomenon takes place, by the first thunder storm. But what can this be? Either a peculiar or permanent electric state communicated to the said columns of air, or a considerable and equally permanent change in its temperature. Volta believes that both these causes contribute to the effect in question.

For a development of these two points we must refer our readers to the original memoir. Suffice it to say, that the subject is handled in that masterly manner which is so peculiar to the illustrious discoverer of the Pile.

The latter part of the letter is necessarily deduced from the explanation of the phenomenon mentioned in the beginning of his paper.

Professor Configliacchi has added a note containing some practical observations in confirmation of what has been advanced by his correspondent. In the year 1814, being at Tuvano, a plain formed by the valleys of Lemna and Molina, not far distant from Pliny's Villa, Sig. Configliacchi witnessed, for fourteen days, a thunder storm occurring at the same hour, over the same place, and lasting the same length of time.

Art. II. *Tavola circolare, &c. or, A circular Table of chemical Equivalents.*

This is Wollaston's table disposed round a moveable circle, within which is one considerably augmented, and somewhat modified. Being carried on to 1000, which corresponds to the 10 of Wollaston in the circle, the inventor takes advantage of this to measure quantities smaller than the latter number,

as 900 will serve for 9, 800 for 8, and so on. It may likewise serve for quantities higher than 1000, since, for instance, 11 may represent for 1100, 12 1200, &c. We may, therefore, mark in this table the weight of carbon, which is 7.54, and that of every other substance below 10.

Another advantage, according to the inventor, is avoiding certain arithmetical operations necessary when using Wollaston's table, for quantities not marked in it, when the proportions of the constituents of a compound are required. Thus, for example, if we require to know the proportion of oxygen n 100 parts of litharge, the circular table will give 7.17, whereas, says the author, to have such result by Wollaston's table, we are obliged to suppose the quantity 200, and divide the result by 2, from the sliding rule, when lowered so as to place 100 against litharge being below oxygen. But surely, this gentleman forgets that the number of oxygen is repeated in more than one place on the scale, and that the operator might refer to the nearest. It is true, that even in that instance, an arithmetical operation would become necessary to complete the operation. Another real advantage of this scale is this, that being circular, and extending from 1 to 1000, by placing a given number against oxygen, we may at once make it to correspond to Dalton's, Davy's, or Berzelius's system.

Art. III. *On the Prehnite found in Tuscany. By Professor* Brocchi.

The Professor relates, that travelling through Tuscany, some time since, the celebrated botanist and naturalist Targioni shewed him several specimens of a rock, composed of *diallage* and compact jade, in which he thought he could perceive some small crystals of very transparent and brilliant feldspar. Subsequent observations, however, have persuaded him of his mistake, for on recently examining more specimens, he ascertained the form of the crystals, to be prehnite, and not, as he had imagined, feldspar. This is, therefore, the first specimen of this mineral substance found in Italy. It occurs near Monteferrato. Its colour is generally white, sometimes gray. It is found 1st. amorphous, in veins, with

unequal fracture, more or less laminar, brilliant, often accompanied by calcareous spar of the same colour. 2ndly. Crystallized in the cavities occurring in the rock, in the form of quadrangular rhomboidal tables, with truncated angles, the faces of the truncatures being slightly striated. The crystals are transparent, splendid, grouped, and small. 3. In lamellar distinct concretions, formed by the union of several imperfect tabular rhombic crystals. Submitted to the action of the blow-pipe, it swells, becomes vesicular, and then fuses easily into a porous glass.

Professor Brocchi has also discovered a variety of prehnite near the same place, compact, resembling in appearance a saccharoid carbonate of lime.

Art. VI. *A Description of two Barometers, one of which marks the Maximum of Elevation, the other that of Depression, during the Absence of the Observer. By the Chevalier* Landriani

It is with pleasure we meet once more the well known name of Landriani in a work of science. The present is one of the many posthumous papers left by the above philosopher to Sig. Bellani, who intended to publish them in a separate volume; instead of this he has confided the most important to the care of Sig. Brugnatelli, that they might be laid before the public, through his journal. The present is the first of the series. The first part of this memoir contains an historical sketch of the various methods adopted by different philosophers to ascertain the changes of the barometer during night, or the absence of the observer; such as those devised by Wren, Romilly, Cumming, Magellan, and others. He next mentions the various schemes practised by himself.

Aware of the extreme difficulty of ever obtaining an exact indication of the barometrical variations occuring during the absence of the observer, and for every minute; Landriani has had recourse to the idea of ascertaining the maximum and minimum of such variations; and this idea, he thinks, he has realised to a degree of accuracy which no other barometrographer has ever obtained. The precision of the observations is carried to within the twelfth of an inch.

We cannot, however, without the assistance of the Plate, undertake to give an intelligible description of the new instrument proposed by Landriani, which seems simple and ingenious.

Art. VII. *Sulla Vibrazione delle Fibre elastiche. Memoria del* Sig. Poisson, *&c.*

This is a translation from the French. The Memoir has been before the English public some time. In this instance the Memoir is accompanied by many critical observations and animadversions.

Part 2d. Observations and Discoveries.

Art. II. *Extract of a Letter from* Van Mons *to* Brugnatelli.

It relates to his obtaining phosphoric æther by a peculiar process; which he, however, describes in a very unsatisfactory manner.

Art. III. *Sopra la Metallizzazione delle Terre. By* Marquis Ridolfi.

The Marquis has repeated the memorable experiments of Dr. Clarke, and besides having obtained the same result as to the reduction of metallic oxides, describes at some length, many other singular results. He has succeeded; for instance, in the reduction of the green oxide of chrome; and as for *zirconium*, he constantly obtained it in less than fifteen minutes, without addition.

Art. V. *On the medicinal Virtues of Chlorine.*

Professor Valletta, chief surgeon at the great hospital at Milan, and an eminent practitioner, in a paper inserted in the Number of the Biblioteca Italiana for January last, denied, in an open manner, that chlorine had been of any advantage in cases of hydrophobia, as stated by Professor Brugnatelli. The latter, however, perfectly confident of the truth of what he had asserted, vindicates his opinion, and gives an historical and detailed account of several authentic facts in which the anti-hydrophobic virtue of chlorine had been recently realized and verified.

Art VI. contains an Account of New Works. These are three in number.

1. *Ricerche sopra la Serie e sopra la Integrazione delle Equazione a differenze parziali.* By Frullani at Florence.
2. *Viaggio al Lago di Garda e al Monte Baldo.* and,
3. *Institutiones pathologicæ.* Auctore Francisco Fanzago.—Patavii.

Art. VII. *Necrology—Death of Klaproth.*

SECONDO BIMESTRE.

MARCH and APRIL, 1817.

Art I. *Esperienze ed Osservazioni sulla Trapiantazione.* By Carradin.

The author of this important Memoir is a naturalist advantageously known in Italy. He seems to have paid much attention to the transplanting of vegetables in general, and to have studied the phenomena by which that operation is generally attended. Thus the change of soil and climate, the vicinity of other plants, and a new mode of cultivation, may so far influence the developement of a vegetable production which has been removed from its native soil, as to change in time many of its principal characters, and even its general nature and formation. Many are the examples drawn from vegetable physiology which may be brought forward in support of this assertion; the present writer has mentioned many; and has at the same time endeavoured to explain the singular effects of transplantation in general. He has made several experiments, which are related in a clear and accurate manner, to prove how far he is right in his conjectures. From his Memoir we may deduce the following practical observations: 1st, that in transplanting trees, &c. the safest mode is, not to touch any of the roots nor to prune them. 2d. that plants thus transplanted need no other nourishment than water; manures, &c. being generally prejudicial: and 3d. that they

should always be preserved from the light of the sun during the first few weeks; as the simple stimulus of that light is sufficient to destroy them.

Art. II. *Richerche ed Osservazioni, &c.:* or, *Observations and Experiments on the Volatility of Substances hitherto considered as fixed bodies. By* Dr. Hermbstaed.

It is perfectly true, as the author of the present Memoir observes, that we have as yet no correct or exact idea of the distinction between a fixed and a volatile body. Generally speaking, we might consider all bodies volatile; as it is most probable that could we produce a sufficient degree of heat, no substance could resist it. It follows therefore that we have no just idea of what a *fixed body* is; and we consequently feel great obligations to Professor Hermbstaed, in having called the attention of chemists to this important point of physical research. The Memoir, which was read before the Royal Academy of Berlin, contains a variety of experiments instituted with a view of throwing some light on the subject under consideration. The first series of experiments was directed to ascertain how far we are right in considering potash as a fixed body, and it results from them that far from being so, the potash is volatilized not only at a high degree of temperature, as hitherto known; but also at the degree of boiling water. Lime, barytes, and strontian, submitted to several experiments, proved that they are volatilized at the common temperature. With regard to the volatility of mercury the Doctor relates a curious fact. At the royal manufactory of looking-glasses in Berlin, during a severe winter, the artificers who worked in a room, which had originally served for the process of *silvering* the glasses, lighted a fire and thus heated the room to between 86° and 96° Fahrenheit. In a few days the whole of them were affected by a strong salivation to their great surprise; as there was no trace of mercury in or near the room. They consulted on the subject; and suspecting the real cause of the event, had the flooring of the room taken up, when about 40lbs. of the metal were found spread about in different parts

where it had fallen at various times during the operation of silvering, which had been executed in that room before. Thus we see mercury volatilized at the temperature of 90°: but the author pushed his inquiry further, and succeeded in finding the minimum of the temperature at which mercury would be volatilized, and found it to be that of 80° Fahrenheit.

Art III. *Letter from* Prof. Catullo *to* Sig. Brigadi, *giving a description of the Alps of the Cadore.*

This is a long but interesting paper on the geological structure of that part of the country which borders the territory of Belluno in the Veronese district. It is, however, not susceptible of curtailment, and must be consulted in the original for any information which might be derived from it.

Art. IV. *On the Efficacy of the Supertrate of Potash in the Cure of the Teigne muqueuse (scald head.)*

This is purely medical, and cannot interest any but medical persons. We may, however, observe that the author, a physician in Piedmont, asserts having cured several cases of scald head in young infants by administering the supertartrate of potash to the mother or wet-nurse, according to the following formula.

℞ Potas. tartrat acid ℥ j. Decoct. rad. gramin. lbj. Sacch ℥ ij. Solv. cap. paulatim.

Art. V. *Sulla Mineralogia della Sicilia.*

This is a critical review of a work on the physical structure and the natural history of Sicily, which admits of no abridgement. The work is by Professor Ferrara.

Art. VI. *Richerche su i Diamant detti di Natura.* By Dr. Bossi.

By *diamanti di Natura,* the Author means those diamonds which the lapidaries cannot in any way or direction cut and shape, from the particular mode of aggregation of their molecules. We confess we did not find any practical or scientific fact of importance in the present article: and as to what regards the crystallographic part of the subject, the Author seems much behind modern writers on that matter. The paper

is illustrated by a plate containing some very indifferent delineations of various crystalline forms of the diamond.

Art. VII. *Some Improvements to Wolfe's Apparatus. By* Chev. Landriani.

This is a continuation of the posthumous works of this celebrated author, and contains, in our opinion, a very ingenious, and easy apparatus, intended to remedy the present troublesome mode of mounting a series of three-necked bottles according to Wolfe, and in which the necessity of luting is done away. A plate accompanies the paper, which would be unintelligible without it; and we shall probably lay before our readers a translation of the Memoir, with the accompanying figures, in our next Number.

PART II.

Observations and Discoveries.

Art. I. *On the Cure of Aneurism.* By Chev. Scarpa.

This eminent Surgeon and Anatomist undertook, in 1816, a series of experiments to ascertain whether the ligature applied to arteries in cases of aneurisms might not safely be removed after a much shorter period of time than has hitherto been done, and thereby shorten the great length of time which has been employed in the cure of that disorder. The result of these experiments was so flattering, and so far in unison with the professor's conjectures, that he has since removed the ligature the third day of the operation, and thus enabled the surgeon to treat and heal the wound by the first intention. Success attended him equally in this part of his experiments, and the present memoir contains the details of a recent operation for popliteal aneurism, performed by Sig. Palletta, according to the method of Scarpa, in which the ligature was removed the 4th day, the wound healed by the first intention, and the patient perfectly cured of his aneurism the fourteenth day after the operation.

Art. III. *On the Nature of Opium. By M.* Sertürner, (from the Annals of Physic, by Gilbert.)

The whole of the memoir of the present Author will shortly be published in the Annales de Chimie. The Author pretends to have found the active principle of the opium, which he has isolated, and to which he has given the name of Morpheine. This principle is combined in the opium, with a peculiar acid to which the name of *meconic* has been given. The morphine is strongly alcaline, and crystallizes in prisms. It is white, little soluble in water, soluble in alcohol, particularly when heated. It forms simple and triple salts—decomposes metallic oxides, &c. &c. We have had occasion, without yet having seen the original paper, to try some experiments; and we are inclined to think that the Author is somewhat mistaken in many, and some of them principal points of his work. We shall lay before our readers the result of our inquiries shortly. We have also seen some physiological experiments made on dogs with the Morphium, and are still more persuaded that M. Sertürner has been too hasty in his assertion. The Morphine, is a substance quite distinct from the salt obtained by De Rosne in France some time since.

Art. VI. Contains an account of new Books, the

1. is *Memorie di Matematica e Fisica della Societa Italiana,* Tom. XVIII.
2. *Teoria sul Calore di Fourier,* 1 vol. 4to.
3. *Geometria di Sito sul Piano e nello Spazio, di Flauti.*
4. *Nuovo Metodo di misurare le più minute frazioni del Tempo. By* Dal Negro.
5. *Prospetto da Risultamenti ottenuti nella Clinica Medica dell' Università di Padova negli anni* 1809 *al* 1815.
6. *Sopra l' Equilibrio di un Poligone qualunque. By* Bordoni.

Meteorological Table.

Journals published in Switzerland.

Bibliothèque Universelle, published at Geneva monthly, by Mon. Pictet.

JANUARY.

Art. I. *Mémoire tendant à demontrer de plus en plus la Force magnetisant du bord extréme du Rayon violet, &c. &c. By* C. Ridolfi.

Our readers must recollect the asserted discovery of Professor Moricchini of Rome, respecting the magnetising power of the violet rays. Notwithstanding the many experiments made by the discoverer in the presence of eminent men who witnessed his success, the discovery has been disputed, controverted, and ridiculed in various parts of Europe, and even in Italy where it was first made. The present writer, a nobleman cultivating the sciences with success, was amongst those who raised a thousand objections against Moricchini's experiment; the result of which has been, that from more specific information on the subject, derived from repeated conversations with the discoverer himself, Marquis Ridolfi, succeeded in magnetising two needles, the one in 30 the other in 46 minutes, and can now charge with the magnetic power, by the same process, as many needles as he pleases. The needles thus magnetised (namely, by directing on and passing over them for a period of not less than 30 minutes the violet rays of the spectrum, through the medium of a condensing lens) possess all the energy and the properties of needles magnetised in the common way by means of a loadstone. Their *homonomous* poles repel, while the *heteronomous* poles attract each other. Made to vibrate on a pivot, their point turns constantly to the north, their heads to the south.

Marquis Ridolfi next proceeded to discover the causes of failure occurring to the philosophers who attempted to repeat the experiment without success; and thinks he has fully ascertained them. At the same time he shews that all the precautions said to be requisite in the performance of the experiment, by Moricchini himself, are needless. Thus he succeeded in magnetising a needle though operating in a room, the atmosphere of which had been previously charged with aqueous vapours.

Marquis C. Ridolfi has sent a needle intensely magnetised by Moricchin's process, to a friend in London, who will be able to judge how far we are to believe in this asserted discovery of the Italian professor.

Art. II. *De Vegetatione et Climate in Helvetia Septentrionali, &c. &c. Auctore* Georgio Wahlenberg, M. D. &c.

A comparison between the climate of Switzerland and that of the northern countries of Europe, by a naturalist who has visited, studied, and knows them both, cannot fail to be interesting to all who cultivate the science of meteorology. His reasoning is founded on observations which may be depended upon, taken for the space of 11 years; and he has calculated the mean temperature in a manner peculiarly his own, and which seems to be correct. Thus he found the mean temperature at the Hospice, St. Gothard (6422 feet above the level of the sea) to be —0.932 centigrades, while that of Peissenbergh in Upper Bavaria (2673 feet above the level of the sea) was for the same space of time +6.156. Zurich is elevated 1125 feet, and Coira in the Grisons 1575 feet; the mean temperature of the former was +8.859; while that of the latter was +9.450. The memoir, however, in the present number is not concluded.

Art. IV. *Experimente über den Kupfergehalt, &c. or Experiments on the Copper contained in certain vegetable Ashes. By* Dr. Meissner.

We cannot say we feel convinced on reading this paper, that the author has really found copper in the ashes of the plants he submitted to his experiments. At all events the quantity in each was so small that he has not himself been able to *appreciate* it.

Art. V. *Le Regne animal distribué d'après son organisation. By* Cuvier.

As we are in hopes to be able to give a full account of this important work in a succeeding Number, we shall not stop to notice here the extracts which the editors of the B. U. have given.

Art. VI. *Sur l'Hygiène des Professions insalubres. By* Dr. Gosse of Geneva.

The unhealthy effluvia to which artificers are exposed in the process of their operations in several manufactures, have often formed the subject of the investigation of physicians; and many are the methods that have been proposed to avoid or diminish their baneful effects on the human constitution. Amongst others we may notice the proposition made by Dr. Macquail, who thought he could sufficiently combat the exhalation by placing small sponges imbued with aromatic liquids into the nostrils. In some manufactures the workmen are supplied with a continual current of pure air, by means of flexible tubes coming from without the room, and suspended from the cieling. Lastly, M. Brizé Fradin invented an instrument which he has called the *tube d'aspiration,* and by which he thought he had wholly provided against the bad effects of insalubrious emanations. This *tube d'aspiration* consists in a cylinder having a glass mouth piece at one of its extremities, and the other being calculated to receive a quantity of cotton pieviously dipped into some appropriate fluid. The instrument thus prepared is fastened to the breast of the workman, and he uses it as he has occasion to approach the place from which the unhealthy effluvia arise; but the writer of the present article very properly observes— that such an instrument is defective in two material points. First, as it does not provide for the exhalations which penetrate the nostrils; and secondly, because the cotton thus imbibed in a given fluid being soon impregnated with the exhaling principles; and becoming, on the other hand, compact by the evaporation, cannot be of much use in checking the inspiration of the miasmata, without frequent changing, which would be very inconvenient. Dr. Gosse to remedy all these inconveniences, and with a view of extending the benefits of the invention to all the manufacturers exposed to unhealthy air, now proposes a whole mask, made with fragments of fine spunges, fastened like an ordinary mask to the face. This simple contrivance answers the purpose intended, if we believe the author, without impeding the free respiration or condemning the workman who uses it, to any

particular motion of the head, as in the case of the *tube d'aspiration.* The mask is of course imbued with an appropriate fluid, according to the exhalation. Thus pure water will suffice in all cases where dust alone is the result of the mechanica operation of the manufacturer; as for instance, colour making, plasterers, shoe-makers, cotton spinners, hatters, furriers, and others. The same fluid suffices for gilders on metals, looking-glass manufacturers, assayers, barometer-makers, &c. &c. when the mercurial and leaden effluvia would be condensed by the low temperature of the spunge. When the vapours consist of acid gases, a simple solution of potash of commerce may be substituted. Thus the manufacturers of nitric muriatic acid and of chlorine, the engraver with aquafortis, the chemists in general, &c. might be preserved from the bad effects of those volatile substances.

In this manner the author goes on enumerating the various fluids necessary in cases of different miasmata; but we cannot follow him through all the catalogue in the short space of this article. The memoir is followed by a series of experiments which the author made on himself to ascertain the efficacy of his method of preservation; and the result of which seem to prove it to the extent he has mentioned in the course of his curious paper.

Art. VIII. *Lettre de M. Lepot à M. Pictet, sur certains Phénomènes des Corps flottans.*

We consider the subject treated in the present letter as merely curious, and certainly as never likely to lead to any useful or practical application. The phenomena exhibited by a fragment of camphor on the surface of water, are known to every one, and the laws of those phenomena have been accurately described and ascertained by an Italian mathematician, several years ago, and published in one of the scientific journals of that country.

Art. IX. Contains a long account of the actual state of the Pontine marshes in the Roman territory—a description of the methods hitherto employed for their drainage; and a proposition for rendering that event more easy of accomplishment.

FEBRUARY.

Art. I. *Præcipuarum Stellarum, &c. Or mean Position of the principal Stars, at the beginning of the 19th century; deduced from observations made at Palermo, since 1792, By* Professor Piozzi, 1814.

The name of Professor Piozzi is well known in England. Astronomy is indebted to him for several important observations, which for accuracy and neatness are inferior to those of no other astronomer. The catalogue of the mean position of the principal stars, mentioned in this article, was first published in 1803, but various reasons, and many new and multiplied observations, having rendered it necessary to publish a second edition of that work, Sig. Piozzi gave to the public the present one, in which the number of the principal stars, whose position he has ascertained by 140,000 observations, amount to 7000.

Art. II. *Sperimenti diretti, &c. or Experiments directed to determine the volume and tension of the elastic vapour of water in pure and mixed gases. By* Professor Michelotti.

We had been preparing a translation of this paper, which the Author has been kind enough to communicate to us in MS. immediately after its having been read at the Royal Academy of Turin; when the present Number of the B. U. fell into our hands.

This French translation being likely to be read by every person who feels an interest in such matters, we shall no longer think of publishing it in this country, where however, the results obtained by Signor Michelotti must excite the attention of the individual to whose exertions we are indebted for the knowledge of that constant and principal law which regulates the formation of vapours. We mean of course Mr. Dalton. Professor Michelotti has employed the method of absorption in his experiments, and on comparing his results with those obtained by the Philosopher of Manchester by the cooling process, we find a very material difference between them. How this can be explained, the author himself has not

ventured to say; but as he admits that the laws of Dalton and Gay Lussac, on the regularity with which the tension of aqueous vapours correspond to the temperature, are quite correct; it remains to be seen by what circumstances the experiments in the present instance have been influenced so as to give results so little consonant with those laws.

Art. III. *De Vegetatione et Climate in Helvetia Septentrionali, &c.*

This is a continuation of the paper mentioned in the analysis of the month of January.

Art. IV. *Récherches sur la Composition et les Propriétés du Naphte d'Amiano. By* T. Saussure.

Amiano is a small place in the Dutchy of Parma, and the naphta found abundantly near it, is employed at Genoa to light the streets of that town, being purchased at a very low price. We believe that a paper on this sort of petroleum was inserted in one of the early volumes of the *Annales de Chimie*, but M. Saussure thinks that the properties of it, and its nature have been but indifferently stated. M. Saussure thinks it might be advantageously substituted for oil of turpentine in various arts. He has found it to possess a greater degree of volatility, a solvent force equally intense—a smell more readily destroyed—that it is not subject to become coloured, or thick, or to be decomposed by the action of light or of the air; and lastly, that the chemical reagents do not easily act upon it. M. Saussure next describes the locality of this naphta, and details several experiments he made upon it. He succeeded in decomposing it, by passing it through a red hot tube of porcelain. By this operation, 22.43 grammes of the naphta gave 4.7, gram. of very dense charcoal with a brilliant and metallic aspect. 4.13 gram. of a brown empyreumatic oil mixed with naphta, and minutely divided charcoal. This oil when sublimed, crystallised in colourless rhomboidal laminæ, thin, transparent, brilliant, and often with their acute angles truncated; 9,697 gr: of carburetted hydrogene gas, 100 parts of which combined with 153.25 oxygen gas, and

formed 77.17 of carbonic acid. There was a loss in this analysis of 3.9 gr: owing to a brown, thick, and oily smoke, passing into the pneumatic trough. The analysis by means of detonation with oxygen, confirmed these results which are that, abstraction being made of a small proportion of azote, the naphta in question is composed of

Carbone	87.6
Hydrogene	12.78
	100.38

the decimal fractions will be done away if we calculate in volumes. Hence M. Saussure concludes that the naphta of Amiano is a super-carburetted hydrogene gas, when compared with olefiant gas, which is composed of

Carb.	85.03
Hydro.	14.97
	100

Art. IX. *A Letter from a M. Watt,* residing at Delemont in Switzerland, on the Aurora borealis of the 8th of February and which it appears has been seen in the mountainous country where the Author resides. The description has nothing remarkable in it, and is only interesting, as the phenomenon in question is of a very rare occurrence in the latitude of the Swiss Cantons.

MARCH.

Art. I. Beobachtungen und Bemerkungen, &c. *or Observations on the great Comet of* 1811. *By* M. Schroeter.

This Memoir is divided into two parts. The first contains a detailed account of the observations that have been made on the comet of 1811. The second presents a summary of those observations and the conclusions which the author draws from them. It results from them that the real length of what is vulgarly called the tail of the comet, was 13,185,200 geographic miles, being a little more than half the distance of the earth from the sun. This extraordinary extent cannot be explained, according to M. Schroeter, but by supposing there

exists around the sun to a great distance from it, a subtle matter susceptible of becoming luminous by the combined influence of the sun and the comet, and which is not uniformly distributed in those vast regions. The Author seems also inclined to adopt the idea, from the appearance of the comets of 1807 and 11, that independant of an attractive force possessed by comets considered as matter—they are gifted with a repulsive and impulsive force, greatly analogous to our electric forces, and which are put into action according to the mass and physical properties of the globes on which they are exerted, sometimes in one, and at other times in quite an opposite direction. The work of M. Schroeter is illustrated by 4 excellent plates.

Art. III. *Sur le Mode d'Emission de la Lumière qui nous fait juger de la couleur propre des corps, &c. By* Benedict Prevost.

Mons. Prevost quarrels with the received names of white, red, yellow, &c. light and rays. With the expression of "to see the light," and with the name of light itself, for which he wishes *luminic* to be substituted—merely because heat and the fluid producing it, have been called *caloric*. After these prefatory observations, M. Prevost goes on to examine the phenomenon of the coloration of bodies, on which subject he exclaims against the word *reflected* rays, which philosophers and opticians in particular have hitherto employed to explain that coloration. According to Professor Prevost's theory, the coloring rays are not reflected but *radiated* from the body in which the decomposition of the *luminic* takes place. Thus a body which appears *red*, radiates the rays of this colour, while the others penetrate the body, are absorbed, combine with its molecules, and are lost to the eye of the observer. These rays radiate in every direction, and are only modified by the intensity of the ight decompounded.

We are really at a loss to discover, how, after having found faults with names, the professor should establish a pretended distinction in the explanation of the coloration of bodies, founded merely upon the adoption of a different name, meaning the same thing. For. M. Prevost has not now to learn

that by *reflection* of the rays, opticians always meant an emission of the particular rays colouring a given body from every point of that surface—and what else can be meant by radiating rays? But even granting that the theory of reflecting rays be distinct from that proposed by M. Prevost, and supposing the former to be, as he pretends, incorrect; we contend that his radiating rays will not explain the phenomena that are often observed in coloured bodies, which seen from different points and in different directions, present each time a different colour—a circumstance which ought not to occur if the colouring rays, radiating in every direction from the coloured body, were one and the same after the absorption of the remaining rays of which light is composed.

Art. V. *Ueber die specifische Gewicht, &c.* or, *Specific Gravity of different elastic Fluids, deduced from stœchiometric calculation. By* M. Meinecke, Professor at Halle.

The author has been at the pains to calculate all the results obtained by the various chemists, who have made experiments on the specific gravity of the different elastic fluids. From these calculations he has deduced a mean specific gravity, which we shall present to our readers, as likely to be of utility in future chemical operations on gases.

TABLE

Of the specific gravities of elastic fluids drawn up from Stœchiometric calculations.

	New Nomenclature by Thenard.	Atmos. air =1.000	Hydr. gas = 1	Oxyg. gas 1.000	Ordinary Nomenclature.
1	Hydrogen gas . .	0.0694	1	0.0625	
2	Proto carburetted hydrogen gas . .	0.5555	8	0.5000	Carburet. hyd. gas.
3	Azotated hydrogen gas	0.5901	$3\frac{1}{2}$	0.5312	Ammon. gas.
4	Vapour of the protoxide of hydrogen .	0.6250	9	0.5625	Watery vapour.
5	Vapour of hydrocyanic acid . . .	0.9374	$13\frac{1}{2}$	0.8437	
6	Gazeous protoxide of carbon . . .	0.9722	14	0.8750	Gaseous oxide of Carbo.
7	Percarburetted hyd. gas	0.9722	14	0.8750	Olefiant gas.
8	Azote . . .	0.9722	14	0.8750	
9	Atmospheric air .	1.000	$14\frac{2}{3}$	0.900	
10	Gaseous deutoxide of azote . .	1.041	15	0.937	Nitrous gas.
11	Oxygene gas .	1.111	16	1.000	
12	Hydrosulphuric acid gas	1.150	17	1.062	Hydro-thionic gas.
13	Hydrochloric acid gas	1.274	$18\frac{1}{2}$	1.156	Muriatic gas.
14	Carbonic acid gas .	1.527	22	1.375	
15	Gaseous protoxide of azote . .	1.527	22	1.375	Gaseous oxide of azote.
16	Alchoholic vapour .	1.597	23	1.437	
17	Vapour of cyanogene .	1.806	26	1.625	
18	Chlorocyanic acid vapour . .	2.153	31	1.937	
19	Sulphurous acid gas .	2.222	32	2.000	
20	Chlorine . .	2.500	38	2.250	Oxymuriatic acid gas.
21	Æthereal vapour .	2.569	37	2.312	
22	Nitrous acid vapour .	2.638	38	2.375	
23	Percarburet of sulphur	2.638	38	2.375	Vap. of Sulf. of Car.
24	Carbohydro-chloric gas	3.473	50	3.125	Phosgene gas.

This table is followed by several important observations full of chemical erudition, and which we lament, from the nature of this part of our Journal, not to be able to give. But we are satisfied with having called the attention of our readers to them, persuaded that they will take an early opportunity of consulting the present translation of the original paper.

Art. VIII. *Ueber Gas beleuchtung, &c. On the Gas Lights employed in London.*

M. Schweigger being in London, took an opportunity of examining this magnificent improvement, for which the English, whatever foreigners may croak to the contrary, have the first practical merit. The author states that from 19 to 20,000 lamps burn with a brilliant light with carburetted hydrogene gas in many of the best streets of London, and that the length of the subterranean tubes which convey the gas amounts actually to 65 English miles: though but a small part of that vast metropolis is yet lighted by this means. The author is strangely mistaken with regard to his statement respecting Mr. Accum; and we cannot guess where he picked up his information. Mr. Accum had long been resident in London before gas-lighting was thought of: and *government*, as M. Schweigger asserts, did certainly *not* send for him to direct that undertaking. Nor is he correct in asserting that Mr. Accum directed the illumination of St. James's Park, and the palace of Carlton House, &c. The lighting of the Mint is, we believe, under Mr. Accum's superintendance.

Art. XIII. *Agriculture. Sur les Blès avariés. By* M. Peschier.

The author having found that the method proposed by Mr. Hatchett for removing the musty flavour of injured wheat, by infusing it in thrice its bulk of boiling water, did not succeed completely, tried a solution of from 3 to 4lbs. of potash of commerce for every 100cwt. of wheat in three times its bulk of water. The wheat is next repeatedly washed, agitated and dried quickly. A wheat which was not only musty but very sour, acquired its natural properties by this method, and served to make some excellent brown bread, in which a slight bitter taste was the only inconvenience remaining. The loss in weight by this operation amounts to one-fifth of the whole.

The next article contains several important subjects of practical and agricultural economy, extracted from the Journal of Agriculture, published at Lausanne; which want of room prevents our translating.

Art. X. *On the Oil contained in the different Species of Corn, considered as the cause of the disagreeable flavour of the Corn Brandy. By* Schrader.

The cause of the unpleasant smell and taste belonging to the brandy distilled from corn, resides in a sebaceous oil, which may be obtained in the distillation of brandy, and may partly be separated by filtering the liquor. Professor Koerte pretends that this oil is formed by the fermentation and manifests itself during distillation. Gehlen, in confirming what Koerte advanced in his work, maintains that the oil is not essential, but fat. In order to settle the matter of discussion, M. Schrader undertook several new experiments on the subject, from which it results, that the disagreeable taste and smell of brandy distilled from grain is really due to the fat oil already mentioned; that this oil pre-exists in the grain employed for the purpose of distillation.

Art. XII. *Les Roses. Par* J. Redouté. Paris chez Didot.

The admirable work of Redouté just completed on the Liliacées, is well known in England. The same writer, with the most laudable zeal for the progress of botany and the arts, has undertaken another periodical publication of nearly an equal importance, and affording full scope for the pencil of so able a pourtrayer of vegetable nature. This work is intended to consist of *twenty livraisons*, each of which will contain six plates, coloured, besides the text, published in 4to. We have seen the first of these livraisons, and we cannot hesitate in placing them amongst the finest of the modern productions in flower painting. The representations of the numerous sub-species of roses cultivated in France is faithful to the utmost.

Art. XIII. *On the Establishments for the Distribution of Soups à la Rumford.*

We have here several improvements suggested in regard to the vessels employed, the fuel consumed, and the ingredients of the soup. The author is Dr. De Roches, of Geneva.

Art. XV. *Notice Biographique sur Feu* M. le Prof. Odier, D.M.

Dr. Odier had been a practitioner at Geneva for upwards of half a century, and had justly acquired a considerable celebrity. He had studied at the University of Edinburgh under Cullen and Black, where he took his degrees in the year 1770. On his return to Geneva, three years afterwards, he was admitted one of the faculty of medicine of the town, and began his practice, which, whether we consider the results he obtained, or the agreeable and luminous manner of his proceeding, has been one of the most brilliant and successful.

In 1796, he became one of the editors of the Bibliothèque Britannique, of which the Journal we are analysing, as our readers know, is a continuation.

He contributed by his translation and extracts from Dr. Jenner's work, to disseminate on the Continent, then shut out from all communication with England, the discovery of the cow-pox; for which he proposed to substitute the name of *Vaccine*, since then generally adopted in Europe. In 1799, he was named honorary professor of medicine at Geneva, and gave several courses of lectures gratuitously, and during a long series of years, he wrote several important tracts, which were printed in the Journal above mentioned.

Dr. Odier died at the age of 79, of a second attack of angina, the 13th of March; leaving behind him a family and numerous friends to regret the heavy loss they have sustained.

*** The unnoticed Articles are either quite uninteresting, or they have already been before our readers, or are extracted from English periodical works.

Art. XV. Meteorological Diary for the Months of March, April, and May, 1817, kept at **Earl Spencer's** Seat at Althorp, in Northamptonshire. The Thermometer hangs in a north-eastern aspect, about five feet from the ground, and a foot from the wall.

METEOROLOGICAL DIARY

for March, 1817.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Saturday	1	42	50	29,58	29,40	SW	SW
Sunday	2	33	45,5	29,55	29,33	WSW	SW
Monday	3	32	47	29,25	28,76	WSW	W
Tuesday	4	34	45	29,05	29,09	W	W
Wednesday	5	29	44	29,10	29,19	W	W
Thursday	6	34	42	28,80	28,98	W	W
Friday	7	29	44	29,10	29,19	W	W
Saturday	8	36	42	28 98	29,19	W	W
Sunday	9	30	43	29,27	29,53	SW	W
Monday	10	29	44	29,77	29,90	WbS	WbN
Tuesday	11	29	49	29,97	29,94	WbN	WbS
Wednesday	12	41	50,5	29,83	29,77	SW	WbS
Thursday	13	45	55	29,78	29,85	WbS	WbN
Friday	14	40	51	30,03	30,09	E	E
Saturday	15	42	48	30,10	30,10	ESE	SW
Sunday	16	41	47	30,08	30,07	ESE	SE
Monday	17	26 5	49,5	30,11	30,17	SE	E
Tuesday	18	32	51	30,13	29,95	E	WSW
Wednesday	19	41	45	29,80	29,73	W	W
Thursday	20	27	35	29,67	29,78	WbN	NW
Friday	21	21	38	29,82	29,82	NW	WbN
Saturday	22	17	39	29,80	29,83	WbN	WbN
Sunday	23	21,5	47	29,87	29,85	SE	WbS
Monday	24	38	52	29,80	29,67	SW	SW
Tuesday	25	39	51	29,63	29,77	WbS	NE
Wednesday	26	29	55	29,77	29,65	WSW	WbS
Thursday	27	32	43	29,88	29,97	WNW	WNW
Friday	28	28	51	29,84	29,72	SW	W
Saturday	29	38	57	29,61	29,64	SW	SW
Sunday	30	42	57	29,90	29,90	W	WbS
Monday	31	36	49	30,01	30,37	W	WbN

METEOROLOGICAL DIARY

for April, 1817.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Tuesday	1	33	55,5	30,40	30,35	E	SE
Wednesday	2	30,5	56	30,30	30,24	SE	NE
Thursday	3	27,5	59	30,24	30,25	ENE	ENE
Friday	4	35	55	30,30	30,27	ENE	E
Saturday	5	32	52	30,27	30,23	E	NE
Sunday	6	29	46	30,30	30,35	NE	NE
Monday	7	38	51	30,39	30,31	ENE	EbN
Tuesday	8	23,5	55	30,18	29,85	SE	W
Wednesday	9	36	48	29,83	29,90	NW	WNW
Thursday	10	31	41	29,91	30,00	NW	NbE
Friday	11	23	45	30,17	30,13	NW	W
Saturday	12	34	49	30,00	29,92	W	W
Sunday	13	41	56	29,96	30,00	W	W
Monday	14	41	55,5	29,99	29,95	WbN	W
Tuesday	15	47,5	56,5	29,88	29,83	W	WNW
Wednesday	16	44,5	50	29,76	29,97	NNW	NNE
Thursday	17	30	43,5	30,12	30,14	N	NNW
Friday	18	27	50	30,26	30,28	NW	W
Saturday	19	29	54	30,31	30,31	NW	WNW
Sunday	20	41	56	30,33	30,32	NW	E
Monday	21	31	55	30,32	30,27	NE	NE
Tuesday	22	33	54	30,27	30,24	NE	NE
Wednesday	23	29,5	48,5	30,18	30,15	NE	NE
Thursday	24	23,5	53	30,17	30,17	NE	NE
Friday	25	33	43,5	30,13	30,10	NE	NE
Saturday	26	36	50	30,05	29,90	N W	NW
Sunday	27	39	49	29,90	30,00	NE	E
Monday	28	35,5	57	30,04	30,00	W	NW
Tuesday	29	43	57	29,90	29,72	W	W
Wednesday	30	39	49,5	29,64	29,70	NW	NbE

METEOROLOGICAL DIARY

for May, 1817.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Thursday	1	37	47	29,79	29,88	NW	NE
Friday	2	36,5	52	29,90	29,88	NE	NNE
Saturday	3	29,5	57,5	29,80	29,70	W	W
Sunday	4	46	59	29,73	29,84	NW	WbN
Monday	5	31	62,5	29,90	29,91	WbS	WSW
Tuesday	6	31,5	57	29,99	30,10	W	NE
Wednesday	7	29	59,5	30.18	30,00	E	SE
Thursday	8	30,5	59	29,80	29,75	ENE	NE
Friday	9	38	49	29,75	29,67	EbN	ENE
Saturday	10	40	58	29,49	29,30	SE	WbS
Sunday	11	38	57	29,40	29,37	WbN	WSW
Monday	12	41	58	29,20	29,28	W	W
Tuesday	13	37	57	29,50	29,59	W	W
Wednesday	14	34	55	29,57	29,57	ESE	W
Thursday	15	33	59	29,63	29,71	WbS	W
Friday	16	32	63	29,85	29,80	SSE	W
Saturday	17	34,5	67	29,77	29,70	W	W
Sunday	18	38	62	29,58	29,43	SE	WNW
Monday	19	40	57	29,46	29,46	N	ENE
Tuesday	20	40	47	29,46	29,46	E	EbN
Wednesday	21	41	45	29,41	29,38	ENE	NW
Thursday	22	40	48	29,38	29,38	W	W
Friday	23	41	57,5	29,40	29,38	WbS	WbS
Saturday	24	32,5	58,5	29,40	29,40	WbS	SSE
Sunday	25	35	53	29,31	29,20	E	EbN
Monday	26	46	58	29,17	29,21	E	ESE
Tuesday	27	41	61	29,34	29,43	ENE	E
Wednesday	28	40	55	29,5[illegible]	29,60	NE	NE
Thursday	29	45	47	29,58	29,63	E	NE
Friday	30	41	51,5	29,76	29,81	NW	NE
Saturday	31	32	55	29,83	29,73	NW	NE

Select List of New Publications, during the last Three Months.

Agriculture and Rural Economy.

Hints for improving the Condition of the Peasantry in all parts of the United Kingdom, by promoting comfort in their Habitations. By Richard Elsam, Esq. 1l. 1s.

Cheap Manure, produced by the newly discovered methods of burning clay. Compiled from the best authorities; with a few hints on the advantages of cutting wheat early. 1s.

Mathematics.

Algebra of the Hindus, with Arithmetic and Mensuration. Translated from the Sanscrit. By H. T. Colebrooke, Esq. 4to. 3l. 3s.

An Essay on the Variation of the Compass. By William Bain, Master, R. N. 8vo. 6s.

Medicine—Surgery.

Considerations on the Moral Management of Insane Persons. By John Haslam, M. D. 8vo. 2s. 6d.

A Treatise on Tetanus; illustrated by a number of cases. By John Morrison, M. D. 8vo. 7s. 6d.

Examination of the Objections made in Britain, against the Doctrines of Gall and Spurzheim. By J. G. Spurzheim, M. D. 8vo. 2s.

Three Familiar Lectures on Craniological Physiology, delivered before the City Philosophical Society. By a Member; with engravings. 8vo. 8s.

A cursory Inquiry into some of the principal causes of Mortality among Children. By John Bunnell Davis, M. D. 8vo. 1s. 6d.

Surgical Observations; being a quarterly report of cases in surgery; treated in Middlesex Hospital, in the Cancer Establishment, and in private practice. By Charles Bell, Esq. part 2 and 3. 8vo. 6s. each.

Observations on the Harveian Doctrine of the Circulation of the Blood, in reply to those lately adduced by George Kerr, Esq. By A. Ewing, M. D. 12mo. 6s.

A Physiological System of Nosology; with a corrected and simplified Nomenclature. By John Mason Good, Esq. 8vo. 1l. 1s.

Medical and Miscellaneous Observations relative to the

West India Islands, during a residence in Jamaica for nearly fourteen years. By John Williamson, M. D. 2 vols. 1l. 5s.

The Hunterian Oration, delivered before the Royal College of Surgeons, Feb. 14, 1817. By William Norris, Master of the College, and Surgeon to the Charter-House and Magdalen Hospital, 4to. 5s.

Letters to a Mother on the Management of Infants and Children. By a Physician, 8vo. 5s. 6d.

An Essay on the Shaking Palsy. By James Parkinson, Member of the Royal College of Surgeons, 8vo. 3s.

Opuscula Medica, iterum edita, auctore Georgio Baker, Serenissimæ Reginæ Charlottæ Medico Ordinario. 8vo. 7s. 6d.

NATURAL HISTORY AND BOTANY.

The Botanical Cabinet; to be continued monthly. Engraved by George Cooke, with descriptions by Conrad Lodiges, and Sons. Foolscap 4to.; wholly coloured, 5s.—partly coloured, 2s. 6d.

A Descriptive Catalogue of Recent Shells, arranged according to the Linnæan method; with particular attention to the synonymy. By Lewis Weston Dillwyn, F. R. S. and F. L. S. 8vo. 2 vols. 1l. 18s.

The Transactions of the Horticultural Society of London, vol. ii. part 5. 4to. 1l. 11s. 6d.

Elements of the Natural History of the Animal Kingdom. By C. Stewart, Member of the Wernerian and Linnæan Societies, 8vo. 2 vols. 1l. 4s.

Flora Anomoia; a general view of the anamolies in the vegetable kingdom. By Thomas Hopkirk; with plates, 8vo. 10s. 6d.

VOYAGES, TRAVELS, AND TOPOGRAPHY.

Illustrations (chiefly geographical) of the History of the Expedition of Cyrus from Sardis to Babylonia, and of the Retreat of the Ten Thousand Greeks. By James Rennell, Esq. 4to. 1l. 16s.

Two Sketches of France, Belgium, and Spa; in two tours during the summers of 1771 and 1816. By the author of Letters from Paris in 1802 and 1803, 8vo. 7s.

A New Companion for Oxford, or Guide through the University; with a series of etchings, 8vo. 4s.

Description of the Characters, Manners, and Customs of the People of India, and their Institutions, Religious and Civil. By the Abbé J. A. Dubois, 4to. 2l. 2s.

A View of the History, Literature, and Religion of the Hindoos; including a minute description of their manners and

customs, and translations from their principal works. By the Rev. W. Ward, 8vo. 2 vols. 18s.

The History of the University of Edinburgh; chiefly compiled from original papers and records never before published. By Alexander Bower, 8vo. 2 vols. 1l. 4s.

Voyages and Travels in various Parts of the World, during the years 1803, 4, 5, 6, and 7. By G. H. Von Langsdorff, 4to. 2 vols. 4l. 10s.

A Narrative of the Briton's Voyage to Pitcairn's Island. By Lieut. Shillibeer, R. N. 8vo. 8s. 6d.

Narrative of a Voyage to Hudson's Bay, in His Majesty's Ship Rosamond; containing some account of the north-eastern coast of America, and of the tribes inhabiting that remote region. By Lieut. Edward Chappel, R. N. 8vo. with plates, 12s.

The History of Java; containing a general description of the country and its inhabitants, the state of agriculture, manufactures, and commerce, the nature of the government and institutions, and the customs and usages peculiar to the people, &c. &c. By Sir Thomas Stamford Raffles, Knt. F. R. S. and F. A. S. late Lieutenant-Governor of that island and its dependencies; with map and plates, 4to. 2 vols. 6l. 6s. *Large paper*, 8l. 8s.

Narrative of the Loss of the American Brig Commerce, wrecked on the Western Coast of Africa in 1815; with an account of the sufferings of her surviving officers and crew, who were enslaved by the Wandering Arabs on the Great African Desert, or Zahahrah; and observations, historical, geographical, &c., made during the travels of the author, while a slave to the Arabs, and in the empire of Morocco. By James Riley, late Master and Supercargo. Preceded by a brief sketch of the author's life; and concluded by a description of the city of Tombuctoo, on the River Niger, and of another large city, far south of it, on the same river, called Wassannah, narrated to the author at Mogadore, by Side Hamet, an Arabian merchant. Printed uniformly with Park's, Adams, and Tuckey's Travels in Africa, 4to. with a map. 1l. 16s.

Letters on Ceylon, particularly relative to the Kingdom of Candy. By Captain L. de Bussche, late Acting Deputy Adjutant General in Ceylon, 8vo. 9s.

INDEX.

D.

E.

F.

G.

H.

I.

N

O

P

R

S

W

Z

London: printed by W. Bulmer and Co.
Cleveland-row St. James's.